

Module Manual

Master of Science

Civil Engineering

Cohort: Winter Term 2018

Updated: 27th September 2018

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Module Manual

Master

Civil Engineering

Cohort: Winter Term 2018

Updated: 27th September 2018

Program description

Content

Civil engineering deals with the erection of buildings of all kind, in particular of structures like bridges and tunnels, structures in hydraulic engineering, water supply, waste and waste water disposal, harbour construction, streets, hall construction, as well as industrial and housing construction, including refurbishment. The master program civil engineering gives graduates the qualification to process difficult projects in the



construction practice, including the necessary competences in business and management. Buildings arise by the cooperation of owners, planning offices, contractors, environment, politicians and society. Civil engineering is located in the field between technical and economic constraint, political will and legal conditions. The master program prepares for that. The master program also opens the way to doctoral studies and successful research activities, assuming a sufficient diploma.

The master program civil engineering is associated with the bachelor program civil engineering and environmental engineering of the University of Technology Hamburg-Harburg in the sense of a consecutive course of studies. Possible entries from other bachelor programs are based on a catalog of requirements, described in the document "Specific Requirements for the Master Program Civil Engineering".

Career prospects

The graduates of the master program civil engineering are prepared for a leading professional activity in planning offices, at building contractors, building authorities, owners of major immovables and infrastructure, producers of building products, material testing institutions and in research facilities. It aims at activities in extensive and difficult projects, or in research and development. In Germany a great demand exists at this time for civil engineers in particular with good knowledge in structural engineering. The master program is based on this demand.

Learning target

The graduates of the master program civil engineering gain the specialist knowledge and the methods, to plan and erect new buildings, in particular concrete structures, steel structures, structures in water engineering, in foundation engineering, in water supply, waste and waste water disposal, including refurbishment of existing structures. This incorporates the realization of necessary preliminary investigations, the design of structural elements, the development of all necessary proofs and the project management.

The graduates of the master program are able to transfer the acquired knowledge in engineering, mathematics and natural sciences to practical applications and to analyze and solve problems on a scientific basis, even if these are unusual or incompletely defined and comprise complex specifications. The graduates are able to successfully work on research projects in the field of civil engineering. Therefore a comprehensive understanding of the underlying processes and the ability to model and calculate such processes, e.g. with Finite Elements Methods, are necessary.

The graduates for this purpose gain the skills to experimentally determine the necessary properties of soil, materials and components and to deal with construction-specific program systems to calculate mechanical behavior, the hydraulics of systems as well as other physical-chemical processes. They are enabled to work on problems of civil engineering and related disciplines on one's own. They are able to use methods needed for the solution of technical problems and planning procedures. They are able to use new findings in a critical way and to improve methods and new developments.

The graduates can communicate on advanced contents and problems of civil engineering with specialists and the laity. They are able to present their methods and the results of their work in writing and verbally in a comprehensive way. The graduates in addition learn to work on problems in a team in a purposeful way, and to document and present their methods and results understandably with up-to-date presentation methods to other persons. They learn to take the leadership for parts of a project or the whole. They are able to familiarize themselves with a topic and to select suitable methods to solve questions and problems. They are able to acquire the necessary information about a topic on one's own and to put the new information in the context of their knowledge.

The graduates are further qualified to develop concept designs for difficult projects in structural engineering, foundation engineering, bridge design and hydraulic engineering and to plan such constructions under consideration of the available information and restrictions. They can:



- successfully cooperate with expert und inexpert partners from the public administration, the economy and science.
- autonomously define, plan and conduct scientific tasks and to theoretically or experimentally investigate constructions, ground, materials, infrastructure as well as management duties,
- responsibly evaluate and consider the interests of building partners, people concerned and the society as a whole.

Program structure

The master program consists of modules which 6 ECTS except for the master thesis. It is divided into a "Core Qualification", into the four alternative specializations "Harbor Construction and Coast Protection", "Underground Engineering", "Structures" and "Water Management and Waste", as well as the master thesis. The core qualification covers 24 ECTS, each specialization covers 66 ECTS and the master thesis covers 30 ECTS. The program covers 120 ECTS in 2 years with 4 terms in total.

The core qualification contains a module "Finite Elements Methods" as well as a module "Sustainability and Risk Management" in the 1st term. In addition an open module during the 1st, 2nd or 3rd term from the field "Business and Management" as well as a module from the "Nontechnical Elective Complementary Courses for Master" are incorporated. The lectures of these open modules are selected from catalogs that are independent from the specific master program.

Each specialization covers 42 ECTS in the compulsory modules, that are indispensable for the specialization, and 24 ECTS in the mandatory electives. They contain also an open module and a project work with 6 ECTS in each case. The compulsory modules are located in the 1st and 2nd term.

The 4th term covers the master thesis. In addition lectures of the open module of the specialization can still be attended in the 4th term. The students must select a specialization and they have the choice to elect different options in the field of "Business and Management", in the field of the "Nontechnical Elective Complementary Courses for Master" and in the mandatory electives of the specialization.

A term abroad is possible. In particular the 3rd semester is used by the students to go abroad, because in the 3rd term there are no compulsory modules, but only mandatory electives.



Core qualification

Module M0523: B	Business & Management
Module Responsible	Prof. Matthias Meyer
Admission Requirements	None
Recommended Previous Knowledge	None
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	 Students are able to find their way around selected special areas of management within the scope of business management. Students are able to explain basic theories, categories, and models in selected special areas of business management. Students are able to interrelate technical and management knowledge.
Skills	 Students are able to apply basic methods in selected areas of business management. Students are able to explain and give reasons for decision proposals on practical issues in areas of business management.
Personal Competence	
Social Competence	 Students are able to communicate in small interdisciplinary groups and to jointly develop solutions for complex problems
Autonomy	 Students are capable of acquiring necessary knowledge independently by means of research and preparation of material.
Workload in Hours	Depends on choice of courses
Credit points	6

Courses

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



Module M0524: Nontechnical Elective Complementary Courses for Master

Module Responsible	Dagmar Richter
Admission Requirements	None
Recommended Previous Knowledge	None
Educational Objectives	l Affar taking nart cuccacctully, ctudante hava reached the following learning reculte
Professional	

Professional Competence

The Nontechnical Academic Programms (NTA)

imparts skills that, in view of the TUHH's training profile, professional engineering studies require but are not able to cover fully. Self-reliance, self-management, collaboration and professional and personnel management competences. The department implements these training objectives in its **teaching architecture**, in its **teaching and learning arrangements**, in **teaching areas** and by means of teaching offerings in which students can qualify by opting for **specific competences** and a **competence level** at the Bachelor's or Master's level. The teaching offerings are pooled in two different catalogues for nontechnical complementary courses.

The Learning Architecture

consists of a cross-disciplinarily study offering. The centrally designed teaching offering ensures that courses in the nontechnical academic programms follow the specific profiling of TUHH degree courses.

The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also provides orientation knowledge in the form of "profiles".

The subjects that can be studied in parallel throughout the student's entire study program - if need be, it can be studied in one to two semesters. In view of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in order to encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the course of studies.

Teaching and Learning Arrangements

provide for students, separated into B.Sc. and M.Sc., to learn with and from each other across semesters. The challenge of dealing with interdisciplinarity and a variety of stages of learning in courses are part of the learning architecture and are deliberately encouraged in specific courses.

Fields of Teaching

Knowledge

are based on research findings from the academic disciplines cultural studies, social studies, arts, historical studies, communication studies, migration studies and sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor's courses will have the opportunity to learn about business management and start-ups in a goal-oriented way.

The fields of teaching are augmented by soft skills offers and a foreign language offer. Here, the focus is on encouraging goal-oriented communication skills, e.g. the skills required by outgoing engineers in international and intercultural situations.

The Competence Level



of the courses offered in this area is different as regards the basic training objective in the Bachelor's and Master's fields. These differences are reflected in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretical level of abstraction in the B.Sc.

This is also reflected in the different quality of soft skills, which relate to the different team positions and different group leadership functions of Bachelor's and Master's graduates in their future working life.

Specialized Competence (Knowledge)

Students can

- explain specialized areas in context of the relevant non-technical disciplines,
- outline basic theories, categories, terminology, models, concepts or artistic techniques in the disciplines represented in the learning area,
- different specialist disciplines relate to their own discipline and differentiate it as well as make connections,
- sketch the basic outlines of how scientific disciplines, paradigms, models, instruments, methods and forms of representation in the specialized sciences are subject to individual and socio-cultural interpretation and historicity,
- Can communicate in a foreign language in a manner appropriate to the subject.

Professional Competence (Skills)

In selected sub-areas students can

- apply basic and specific methods of the said scientific disciplines,
- aquestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specialist discipline,

Skills

- to handle simple and advanced 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 the technical relationship to the subject.

Personal Competence

Personal Competences (Social Skills)

Students will be able

- to learn to collaborate in different manner,
- to present and analyze problems in the abovementioned fields in a partner or group situation in a manner appropriate to the addressees,
- to express themselves competently, in a culturally appropriate and gender-sensitive manner in the language of the country (as far as this study-focus would be chosen),
- to explain nontechnical items to auditorium with technical background knowledge.

Social Competence

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



Autonomy	 application to organize themselves and their own learning processes to reflect and decide questions in front of a broad education background to communicate a nontechnical item in a competent way in writen form or verbaly to organize themselves as an entrepreneurial subject country (as far as this study-focus would be chosen)
Workload in Hours	Depends on choice of courses
Credit points	6

Courses

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



Courses					
Title			Тур	Hrs/wk	СР
Finite Element Methods (L	·		Lecture	2	3
Finite Element Methods (L	_0804)		Recitation Section (large)	2	3
Module Responsible	!				
Admission Requirements	None				
Recommended Previous Knowledge	Mechanics I (Statics, Mechanics of Materials) and Mechanics II (Hydrostatics, Kinematics, Dynamics) Mathematics I, II, III (in particular differential equations)				
Educational Objectives	LATTER TAKING DART SUCCESSIUM STUGENTS DAVE REACHED THE TOMOWING JEARNING RESULTS				
Professional					
Competence Knowledge	The students possess a method and are able to method.				
Skills	The students are capal elements, assembling the equations.	~		-	
Personal Competence Social Competence	Ctudonto con work in am	all groups on specific	problems to arrive at joi	int solutions	s.
Autonomy	The students are able to independently solve challenging computational problems and develop own finite element routines. Problems can be identified and the results are critically scrutinized.				
Workload in Hours	Independent Study Time	124, Study Time in Le	ecture 56		
Credit points	6				
Studienleistung	Compulsory Bonus No 20 %	Form Midterm	Descriptio	on	
Examination	Written exam				
Examination duration and scale	I 120 min				
Credit points Studienleistung Examination Examination duration	6 Compulsory Bonus No 20 % Written exam	Form Midterm qualification: Compuls ualification: Elective Cering: Specialisation A	Description ory ompulsory ircraft Systems: Elective	e Compulsc	



	Computational Science and Engineering: Specialisation Scientific Computing: Elective
	Compulsory
	International Management and Engineering: Specialisation II. Mechatronics: Elective
	Compulsory
	International Management and Engineering: Specialisation II. Product Development and
	Production: Elective Compulsory
Assignment for the	Mechatronics: Core qualification: Compulsory
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Compulsory
	Biomedical Engineering: Specialisation Management and Business Administration: Elective
	Compulsory
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective
	Compulsory
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective
	Compulsory
	Product Development, Materials and Production: Core qualification: Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory
	Technomathematics: Core qualification: Elective Compulsory
	Theoretical Mechanical Engineering: Core qualification: Compulsory

Course L0291: Finite Element Methods		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Otto von Estorff	
Language	EN	
Cycle	WiSe	
Content	- General overview on modern engineering - Displacement method - Hybrid formulation - Isoparametric elements - Numerical integration - Solving systems of equations (statics, dynamics) - Eigenvalue problems - Non-linear systems - Applications - Programming of elements (Matlab, hands-on sessions) - Applications	
Literature	Bathe, KJ. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin	

Course L0804: Finite Element Methods		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Otto von Estorff	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Madula M0060. C	Protoinghility and Dials Ma			
Module M0962: S	Sustainability and Risk Ma	nagement		
Courses				
Title		Тур	Hrs/wk	СР
Safety, Reliability and Risl		Seminar	2	3
Environment and Sustaina		Lecture	2	3
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, stude	ents have reached the followi	ng learning resu	its
Professional Competence				
Knowledge	 and risk assessment as well as enveloped basics in safety and reliability safety and reliability analysis risk assessment Production and usage of biden energy production and supposustainable product design 	ity of technical facilities is methods o-char ply	engineering, in c	etail:
Skills	Students are able apply interdisciplinary system-oriented methods for risk assessment and sustainability reporting. They can evaluate the effort and costs for processes and select economically feasible treatment concepts.			
Personal				
Competence				
Social Competence Autonomy	Students can gain knowledge of the subject area from given sources and transform it to new questions. Furthermore, they can define targets for new application or research-oriented duties in for risk management and sustainability concepts accordance with the potential social, economic and cultural impact.			
Workload in Hours	Independent Study Time 124, Stud	y Time in Lecture 56		
Credit points	6			
Studienleistung				
Examination	Written elaboration			
Examination duration and scale	Elaboration and presentation (45 n	ninutes in groups)		
_	Civil Engineering: Core qualification: Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Product Development, Materials and Production: Specialisation Product Development: Elective Compulsory Product Development, Materials and Production: Specialisation Production: Elective Compulsory Product Development, Materials and Production: Specialisation Materials: Elective Compulsory Water and Environmental Engineering: Core qualification: Compulsory			

TUHH

Course L1145: Safety,	Reliability and Risk Assessment		
Тур	Seminar		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Dr. Marco Ritzkowski		
Language	DE		
Cycle	WiSe		
Content	An introduction in safety and risk assessment is given and some typical problems of structural and environmental engineering are treated: • basics in safety and reliability of technical facilities • safety and reliability analysis methods • risk assessment • practical examples and excursions • discussions and presentations		
Literature	 Vorlesungsunterlagen Schneider, J., Schlatter, H.P.: Sicherheit und Zuverlässigkeit im Bauwesen. www.risksafety.ch/files/sicherheit_und_zuverlaessigkeit.pdf 		

тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
	This course presents actual methodologies and examples of environmental relevant sustainable technologies, concepts and strategies in the field of energy supply, production, water supply, waste water treatment or mobility. The following list show examples. Production and Usage of Bio-char Engergy production with algae Environmental product design Clean Development mechanism (CDM) Democracy and Energy New Concepts for a sustainable Energy Supply Recycling of Wind Turbines Alternative Mobility
	Disposal of Nuclear Wastes Waste2Energy Offshore Wind energy



Specialization Coastal Engineering

Module M0699: A	dvanced	Foundat	ion Engir	neering	and Soil Labo	oratory Co	ourse
Courses							
Title Soil Laboratory Course (L0499) Advanced Foundation Engineering (L0497) Advanced Foundation Engineering (L0498)				Typ Practical Course Lecture Recitation Section (lar	Hrs/wk 1 2 ge) 1	CP 2 2 2	
Module Responsible	Prof. Jürgen	Grabe					
Admission Requirements	None						
Recommended Previous Knowledge							
Educational Objectives	After taking p	oart successf	ully, student	s have rea	ached the following	learning resu	lts
Professional Competence Knowledge Skills Personal Competence Social Competence Autonomy							
Workload in Hours	Independen	t Study Time	124, Study 7	Time in Le	cture 56		
Credit points	6						
Studienleistung	Yes Yes	y Bonus None	Form Subject practical w	theoreti vork	Descrij cal and	otion	
Examination	Written exan	n					
Examination duration and scale	60 min						
Assignment for the Following Curricula	Civil Engine Civil Engine Civil Engine	ering: Specia ering: Specia ering: Specia I Manageme	alisation Geo alisation Coa alisation Wat	technical stal Engir er and Tra	gineering: Compulso Engineering: Comp neering: Compulsor affic: Elective Compo Specialisation II.	oulsory y ulsory	ering: Elective



Course L0499: Soil Laboratory Course		
Тур	Practical Course	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
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 L0497: Advance	ced Foundation Engineering
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	WiSe
Content	 Vertical drains Piles Ground improvement (Deep Compaction, Soil mixing) Vibration driving Jet grouting Slurry wall Deep excavation
Literature	 EAK (2002): Empfehlungen für Küstenschutzbauwerke EAU (2004): Empfehlungen des Arbeitsausschusses Uferbauwerke EAB (1988): Empfehlungen des Arbeitskreises Baugruben Grundbau-Taschenbuch, Teil 1-3, (1997), Ernst & Sohn Verlag



Course L0498: Advanced Foundation Engineering		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0858: C	Coastal Hydraulic Engineering I			
Courses				
Title Basics of Coastal Enginee	ering (L0807)	Typ Lecture	Hrs/wk	CP 4
Basics of Coastal Enginee	ering (L1413)	Project-/problem-based Learning	1	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of hydraulic engineering, hydrology	and hydromechanics		
Educational Objectives	After taking part successfully, students have	e reached the following lea	arning resu	lts
Professional Competence				
Knowledge	The students are able to define and explain the basic concepts of coastal engineering and port engineering. They are able to apply the concepts to selected practical problems of coastal engineering. Students can define and determine the basics for design and dimensioning of coastal engineering constructions.			
Skills	The students are capable to apply basic design approaches to selected and pre-defined design tasks in coastal engineering.			
Personal				-
Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as the design of coastal protection structures. Additionaly, they will be able to work in team with engineers of other disciplines, for instance designing of coastal breakwaters.			
Autonomy	The students will be able to independently extend their knowledge and applyit to new problems.			
Workload in Hours	Independent Study Time 124, Study Time in	n Lecture 56		
Credit points	6			
Studienleistung				-
-	Written exam			-
	The duration of the examination is 2 hours. general understanding of the lecture conter			respect to the
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Civil Engineering: Specialisation Geotechn Civil Engineering: Specialisation Coastal E International Management and Engineeri Compulsory	ical Engineering: Compul ngineering: Compulsory	sory	ering: Elective



Course L0807: Basics	of Coastal Engineering
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	 Design-approaches Filter Rubble mound constructions Piles Vertical constructions
Literature	Coastal Engineering Manual, CEM Vorlesungsumdruck

Course L1413: Basics	Course L1413: Basics of Coastal Engineering		
Тур	Project-/problem-based Learning		
Hrs/wk	1		
СР	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Peter Fröhle		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0964: S	tructures in Foundation a	nd Hydı	aulic Engineerin	g	
Courses					
Title Steel Structures in Found Underground Constructio Underground Constructio			Typ Lecture Lecture Recitation Section (large)	Hrs/wk 2 1	CP 3 2 1
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	None				
Recommended Previous Knowledge	Modules from Bachelor studies Civil Geotechnics I-II Steel Structures I-II	and envir	onmental engineering:		
Educational Objectives	After taking part successfully, studer	nts have re	ached the following lea	arning resul	ts
Professional Competence					
Knowledge	Knowledge of different tunnel construction types as well as special methods and techniques of subsoil construction. The students get deeper knowledge of steel and ground engineering as well as constructions knowledge concerning quay walls. Futhermore, the students get all the neccessary knowledge to design singular construction elements for sheet pile walls and they know how to choose the right construction elements depending on the influencing conditions.				
Skills	Basic knowledge of tunnel design as well as practical skills in structural tunnel analysis. Furthermore, the students are able to dimension sheet pile wall construction regarding all construction elements, to choose the suitable construction elements with respect to the influencing conditions, to design all kinds of sheet pile walls (wave sheet pile walls and combined sheet pile walls) and to dimension all construction elements and connections.				
Personal					
Competence	Capacity for teamwork concerning p	roject mar	nagement and design o	f tunnale	
·	Promotion of independent and creat	-	-		ercise.
	Independent Study Time 124, Study			<u> </u>	
Credit points					
Studienleistung					
Examination	Written exam				
Examination duration and scale	120 minutes				
_	Civil Engineering: Specialisation Str Civil Engineering: Specialisation Ge Civil Engineering: Specialisation Co Civil Engineering: Specialisation Wa International Management and Er Compulsory	otechnica pastal Engi ater and Tr	l Engineering: Compuls neering: Compulsory affic: Elective Compuls	ory	ring: Elective



Course L1146: Steel Structures in Foundation and Hydraulic Engineering		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Frank Feindt	
Language	DE	
Cycle	WiSe	
Content	Design of a sheet pile wall, design of a combined sheet pile wall, piles, walings, connections, fatigue	
Literature	EAU 2012, EA-Pfähle, EAB	

	Leat in
	Lecture
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Marius Milatz
Language	DE
Cycle	WiSe
Content	 Definitions Historical development in tunneling Geology for tunneling Hard rock tunneling (construction composite and machines) Tunnelung in temporarly stable soil with conventional construction methods Tunneling in soft soils (form of supports, shield types, compressed air application) Pipe jacking Tunnel Lining, tunnel supporting structures Calculation approaches for supporting structures in shield-driven tunnels Surveying for tunneling Safety requirements Construction Contract Literature and sources
Literature	 Vorlesung/Übung s. www.tu-harburg.de/gbt

Course L1811: Underground Constructions		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Marius Milatz	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



\				
Courses				
Fitle Panawahla Enargy Praisa	to in Emerged Markets (LOO14)	Typ	Hrs/wk	CP
Hydro Power Use (L0013	ts in Emerged Markets (L0014)	Project Seminar Lecture	1	1
Vind Turbine Plants (L001)		Lecture	2	3
Nind Energy Use - Focus	•	Lecture	1	1
Module Responsible	Dr. Joachim Gerth			
Admission Requirements	None			
- 4	Module: Technical Thermodynamics I	,		
Recommended	Module: Technical Thermodynamics I	I,		
Previous Knowledge	Module: Fundamentals of Fluid Mecha			
Educational Objectives	After taking part successfully, students	s have reached the followir	ng learning resu	Its
Professional Competence				
By ending this module students can explain in detail knowledge of wind turbin particular focus of wind energy use in offshore conditions and can critical commaspects in consideration of current developments. Furthermore, they are describe fundamentally the use of water power to generate electricity. The students and explain the basic procedure in the implementation of renewable energy countries outside Europe.			omment these are able tents reproduce	
	Through active discussions of vario improve their understanding and the able to transfer what they have learned	application of the theoret		
Skills	Students are able to apply the acquired theoretical foundations on exemplary water or wind power systems and evaluate and assess technically the resulting relationships in the context of dimensioning and operation of these energy systems. They can in compare critically the special procedure for the implementation of renewable energy projects in countries outside Europe with the in principle applied approach in Europe and can apply this procedure of exemplary theoretical projects.			
Personal				
Competence Social Competence	Students can discuss scientific tasks	subjet-specificly and multic	lisciplinary withi	n a seminar.
Autonomy	Students can independently exploit sources in the context of the emphasis of the lecture material to clear the contents of the lecture and to acquire the particular knowledge about the subject area.			
Workload in Hours	Independent Study Time 110, Study T	ime in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	3 hours written exam			



Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Energy Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Renewable Energy: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Product Development, Materials and Production: Specialisation Product Development: Assignment for the Elective Compulsory **Following Curricula** Product Development, Materials and Production: Specialisation Production: Elective Compulsory Product Development, Materials and Production: Specialisation Materials: Elective Compulsory Renewable Energies: Core qualification: Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory Theoretical Mechanical Engineering: Specialisation Energy Systems: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory

Water and Environmental Engineering: Specialisation Environment: Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory



Course L0014: Renewable Energy Projects in Emerged Markets		
Тур	Project Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Andreas Wiese	
Language	DE	
Cycle	SoSe	
Content	1. Introduction ○ Development of renewable energies worldwide ■ History ■ Future markets ○ Special challenges in new markets - Overview 2. Sample project wind farm Korea ○ Survey ○ Technical Description ○ Project phases and characteristics 3. Funding and financing instruments for EE projects in new markets ○ Overview funding opportunitie ○ Overview countries with feed-in laws ○ Major funding programs 4. CDM projects - why, how , examples ○ Overview CDM process ○ Examples ○ Examples ○ Exercise CDM 5. Rural electrification and hybrid systems - an important future market for EE ○ Rural Electrification - Introduction ○ Types of Elektrizifierungsprojekten ○ The role of the EEInterpretation of hybrid systems ○ Project example: hybrid system Galapagos Islands 6. Tendering process for EE projects - examples ○ South Africa ○ Brazil 7. Selected projects from the perspective of a development bank - Wesley Urena Vargas, KfW Development Bank ○ Geothermal ○ Wind or CSP Within the seminar, the various topics are actively discussed and applied to various cases of application.	



Course L0013: Hydro Power Use		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Stephan Heimerl	
Language	DE	
Cycle	SoSe	
Content	 Introduction, importance of water power in the national and global context Physical basics: Bernoulli's equation, usable height of fall, hydrological measures, loss mechanisms, efficiencies Classification of Hydropower: Flow and Storage hydropower, low and high pressure systems Construction of hydroelectric power plants: description of the individual components and their technical system interaction Structural engineering components; representation of dams, weirs, dams, power houses, computer systems, etc. Energy Technical Components: Illustration of the different types of hydraulic machinery, generators and grid connection Hydropower and the Environment Examples from practice 	
Literature	 Schröder, W.; Euler, G.; Schneider, K.: Grundlagen des Wasserbaus; Werner, Düsseldorf, 1999, 4. Auflage Quaschning, V.: Regenerative Energiesysteme: Technologie - Berechnung - Simulation; Carl Hanser, München, 2011, 7. Auflage Giesecke, J.; Heimerl, S.; Mosony, E.: Wasserkraftanlagen Planung, Bau und Betrieb; Springer, Berlin, Heidelberg, 2009, 5. Auflage von König, F.; Jehle, C.: Bau von Wasserkraftanlagen - Praxisbezogene Planungsunterlagen; C. F. Müller, Heidelberg, 2005, 4. Auflage Strobl, T.; Zunic, F.: Wasserbau: Aktuelle Grundlagen - Neue Entwicklungen; Springer, Berlin, Heidelberg, 2006 	



Course L0011: Wind Turbine Plants		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Rudolf Zellermann	
Language	DE	
Cycle	SoSe	
Content	 Historical development Wind: origins, geographic and temporal distribution, locations Power coefficient, rotor thrust Aerodynamics of the rotor Operating performance Power limitation, partial load, pitch and stall control Plant selection, yield prediction, economy Excursion 	
Literature	Gasch, R., Windkraftanlagen, 4. Auflage, Teubner-Verlag, 2005	



Course L0012: Wind Energy Use - Focus Offshore		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Skiba	
Language	DE	
Cycle	SoSe	
Content	 Introduction, importance of offshore wind power generation, Specific requirements for offshore engineering Physical fundamentals for utilization of wind energy Design and operation of offshore wind turbines, presentation of different concepts of offshore wind turbines, representation of the individual system components and their system-technical relationships Foundation engineering, offshore site investigation, presentation of different concepts of offshore foundation structures, planning and fabrication of foundation structures Electrical infrastructure of an offshore wind farm, Inner Park cabling, offshore substation, grid connection Installation of offshore wind farms, installation techniques and auxiliary devices, construction logistics Development and planning of offshore wind farms Operation and optimization of offshore wind farms Day excursion 	
Literature	 Gasch, R.; Twele, J.: Windkraftanlagen - Grundlagen, Entwurf, Planung und Betrieb; Vieweg + Teubner, Stuttgart, 2007, 7. Auflage Molly, J. P.: Windenergie - Theorie, Anwendung, Messung; C. F. Müller, Heidel-berg, 1997, 3. Auflage Hau, E.: Windkraftanalagen; Springer, Berlin, Heidelberg, 2008, 4.Auflage Heier, S.: Windkraftanlagen - Systemauslegung, Integration und Regelung; Vieweg + Teubner, Stuttgart, 2009, 5. Auflage Jarass, L.; Obermair, G.M.; Voigt, W.: Windenergie: Zuverlässige Integration in die Energieversorgung; Springer, Berlin, Heidelberg, 2009, 2. Auflage 	



Module M1351: C	construction Process	ses		
Courses				
Title		Тур	Hrs/wk	СР
Digital Building (L1908)		Lecture	2	2
Lean Construction (L1910		Lecture	2	2
System Dynamics (L1909)	Lecture	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge				
Educational Objectives	After taking part successfull	y, students have reached the follo	wing learning resu	lts
Professional				
Competence				
Knowledge				
Skills				
Personal				
Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96	6, Study Time in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	60 min			
_	Civil Engineering: Specialis Civil Engineering: Specialis	sation Coastal Engineering: Electives ation Geotechnical Engineering: Esation Structural Engineering: Elective Coation Water and Traffic: Elective Coation	Elective Compulsor tive Compulsory	ry

Course L1908: Digital Building	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Katja Maaser
Language	DE
Cycle	SoSe
Content	
Literature	



Course L1910: Lean C	Course L1910: Lean Construction	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Theo Herzog	
Language	DE	
Cycle	SoSe	
Content		
Literature		

Course L1909: System Dynamics	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Nicole Mörchen, Dr. Markus Salge
Language	DE
Cycle	SoSe
Content	
Literature	



wodule WU593: E	Building Materials and	Building Pre	eservation		
Courses					
Title Anchor Technology and E Repair of Structures (L02: Mineral Building Materials			Typ Recitation Section (small) Lecture Lecture	Hrs/wk 1 1 2	CP 1 1 2
Technology of mineral Bu			Project-/problem-based Learning	1	1
Transport Processes in B	uilding Materials and Damage Pr		Lecture	1	1
Module Responsible	Prof. Frank Schmidt-Döhl				
Admission Requirements	None				
Recommended Previous Knowledge	Basic knowledge about be example by the modules Pr Materials and Building Cher	rinciples of Buildin			
Educational Objectives	After taking part successfully	v, students have re	ached the following lea	rning resu	Its
Professional Competence					
·	The students are able to describe the components of mineral building materials and their function in detail and to use them for the manufacture of special mineral building materials. They are able to show the characteristics of mineral building materials. They are able to describe the manufacture, properties and fields of application of special mortars and special concretes and the correlations of their material parameters. They are able to show the principles of anchor technology and design.				
Skills	The students are able to perform an optimization of granulometry of a mineral building material. They are able to design a special mineral mortar and to manufacture this mortar. The students are able to manufacture post installed rebar connections. They are able to recognize damages, to assess possible causes, to use the fundamentals of construction preservation and to select repair and strengthening measures.				
Personal Competence					
Social Competence	The students are able to develop in small grous the mixture of a special mortar. They presen their results to the lecturer and the other students. In a critical discussion they defend and adjust their results. The students are able to manufacture their special building material on the basis of this feedback.				
Autonomy	The students are able to responsibly use the resources of materials and lab equipment for their project and to investigate and to get missing components.				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84				
Credit points	6				
Studienleistung	Yes 20 %	F orm Subject theoret Fractical work	Descriptio ical and	n	
Examination	Written exam	radioal Work			
Examination duration and scale	120 min				
and scale					



Assignment for the
Following Curricula

Civil Engineering: Specialisation Geotechnical Engineering: Compulsory
Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory

Course L0257: Anchor	r Technology and Design, Post Installed Rebar Connections
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	 Working principles of friction, keying and bonding anchors Selection of anchors Anchor design Installation of anchors Post installed rebar connections and additional german regulations
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung Beton-Kalender 2012: Infrastrukturbau, Befestigungstechnik. Eurocode 2. Herausgegeben von Konrad Bergmeister, Frank Fingerloos und Johann-Dietrich Wörner; 2012 Ernst & Sohn GmbH & Co. KG. Published by Ernst & Sohn GmbH & Co. KG. DIBt: Hinweise für die Montage von Dübelverankerungen; Oktober 2010 Ratgeber Dübeltechnik, Basiswissen - Metalldübel, chemische Dübel, Kunststoffdübel; Herausgeber Hilti AG

Course L0255: Repair of Structures	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Maintenance of structures, repair and strengthening, subsequent waterproofing of structures
Literature	BetonMarketing Deutschland (Hrsg.): Stahlbetonoberflächen - schützen, erhalten, instandsetzen



Course L0253: Mineral 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	SoSe
Content	Components of mineral building materials and their function, binding materials, concrete and mortar, special mortars, special concretes
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis

Course L0256: Technology of mineral Building Materials	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Design and production of a special mineral building material
	Taylor, H.F.W.: Cement Chemistry
Literature	Springenschmid, R.: Betontechnologie für die Praxis

Course L0254: Transport Processes in Building Materials and Damage Processes	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl, Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	Transport Processes in Building Materials and Damage Processes
Literature	Blaich, J.: Bauschäden, Analyse und Vermeidung



Module M0723: D	esign of Prestressed Structures a	and Concrete Bri	dges	
Courses				
=	ructures and Concreet Bridges (L0603) ructures and Concreet Bridges (L0604)	Typ Lecture Recitation Section (large)	Hrs/wk 3 2	CP 4 2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
Recommended Previous Knowledge	Detailed knowledge on the design of concrete	structures.		
Educational Objectives	After taking part successfully, students have re	ached the following lea	rning results	5
Professional Competence				
Knowledge	The students know the main bridge types, their applications and the various loads. They can explain the basic design methods. They can explain the design of a prestressed bridge.			
Skills	The students are able to design reinforced or p	orestressed concrete bri	idges.	
Personal Competence				
Social Competence	The students can design in teamwork a real co	oncrete bridge.		
Autonomy	The students are able to design a prestressed concrete bridge and discuss the problems and results with other students.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points				
Studienleistung				
Examination	Written exam			
Examination duration and scale	180 minutes			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory			



ourse L0603: Design of Prestressed Structures and Concreet Bridges	
Typ Lecture	
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	Concrete bridges • history of bridges • design of bridges • loads on bridges • member forces for slab, T-beam, hollow box, frame and arch bridges
	 precast bridges - precast segmental bridges bearings abutments, columns construction methods Vorlesungsumdruck Rombach, G. (2003): Spannbetonbau. Ernst & Sohn, Berlin Wicke, M. (2002): Anwendung des Spannbetons. Betonkalender 2002, Teil II, S. 113-180, Verlag Ernst & Sohn, Berlin
Literature	 Leonhardt, F. (1980): Vorlesungen über Massivbau. Teil 5: Spannbeton. Berlin Mehlhorn, G. (2007): Handbuch Brücken, Springer Verlag Schäfer, H.; Kaufeld, K. (1997): Massivbrücken. Betonkalender Teil II, S. 443ff, Ernst 8 Sohn, Berlin Menn, Ch. (1986): Stahlbetonbrücken. Springer Verlag, Wien



Course L0604: Design	ourse L0604: Design of Prestressed Structures and Concreet Bridges	
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0756: S	Soil Mechanics and	-Dynamics			
module moreo. e		Dynamios			
Courses					
Title			Гур	Hrs/wk	СР
Soil Mechanics - Selected	d Topics (L0374)		_ecture	2	2
Soil Dynamics (L0452)		L	ecture	3	2
Experimental Researches	s in Geotechnics (L0706)	F	Practical Course	1	2
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	INONE				
Recommended	modules: Mathematics I-I	III, Mechanics I-II, Geot	echnics I		
	courses: Soil laboratory c	course, (Applied structu	ıral dynamics)		
Educational Objectives	After taking part successi	fully, students have rea	ched the following	learning resu	Its
Professional Competence					
Competence	After the successful comp	pletion of the module th	a etudente ehould	he able to:	
		pply the basic equation			
	• to understand the the relevant parar	e wave propagation in t meters.	tne soli under dyna	amic excitation	and to detect
	 to know the essential laboratory and field tests to determine soil dynamic 				
		d to evaluate them,			
	to design machine foundations to dynamic load,				
	 to measure shocks to perform vibration forecast, to evaluate shocks in term to their effect on people and buildings, 				
		pilities of isolation,		,g.,	
	 to understand mechanisms that cause earthquakes and evaluate earthquake in term of 				
Knowledge					
	 to know methods to determine axial pile capacity, integrity and the dynamic bedding modulus, 				
	 to know the mechanisms that lead to a deformation accumulation due to cyclic loading 				
	and to estimate these deformations mathematically,				
	 to distinguish the area of application of the method of elastodynamics and plastodynamics, 				
	practice y named,				
	• to detect the undrained shear strength as a function of a number of state variables,				
	 to capture the visous behaviour of cohesive soils and to consider the effects of creep and rate-dependent shear strength in calculations, 				
		pact of the partly satur		and shear stre	ength.
O					
Skills	!				
Personal Competence					
Social Competence	-				
Autonomy	-				
	Independent Study Time	96, Study Time in Lect	ure 84		
Credit points	<u> </u>	-			
	Compulsory Bonus	Form	Descri	ption	
Studienleistung		Subject theoretic	·		
	100 10 /0	practical work			
Examination	Oral exam				



Examination duration and scale	
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Course L0374: Soil Mechanics - Selected Topics		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Hans Mathäus Stanford	
Language	DE	
Cycle	SoSe	
Content	selected topis: - continuum mechanis - constitutive modelling - time and rate dependend material behavior of soils - cyclic loading - undrained conditions	
Literature	Kolymbas D. (2007): Geotechnik - Bodenmechanik, Grundbau und Tunnelbau. Springer Verlag	



Course L0452: Soil Dynamics		
Тур	Lecture	
Hrs/wk	3	
СР	2	
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42	
Lecturer	Dr. Sascha Henke	
Language	DE	
Cycle	SoSe	
Content	 mass-spring-damper systems, wave propagation in soils, dynamic soil parameters, Determination of dynamic soil parameters, machine foundations, in-situ measurement of ground motion, ground motion prediction, evaluation of ground motion, ground motion shielding, introduction into earthquake engineering, dynamic pile tests, cyclic accumulation, plastodynamics 	
Literature	 Das B.M.: Fundamentals of Soil Dynamics, Elsevier Empfehlungen des Arbeitskreises Baugrunddynamik. Hrsg. Deutsche Gesellschaft für Geotechnik (DGGT) Haupt W.: Bodendynamik. Vieweg und Teubner Meskouris K. und Hinzen KG.: Bauwerke und Erdbeben. Vieweg Verlag Studer J.A., Koller M.G. und Laue J.: Bodendynamik, Springer Verlag 	



Course L0706: Experi	imental Researches in Geotechnics
Тур	Practical Course
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Marius Milatz
Language	DE
Cycle	SoSe
Content	become acquainted with geotechnical model tests, field tests and laboratory tests as well as corresponding measurement techniques. These compromise amongst others inclinometer measurements and geophone measurements as well as high-grade laboratory tests on the stress-strain relationship of soil specimens, e. g. triaxial tests, simple shear tests and resonant column tests. gain insight into current soil mechanical research. plan, coordinate, perform and evaluate soil mechanical tests in a team. discuss, reflect, review and present the obtained results in a group. An important learning target is the introduction to scientific work for students who plan a scientific career, and for those who will work in practice with the responsibility to order corresponding tests and evaluate the results. The practical laboratory work is based on annualy changing problems, which are however related to the experience and results of the preceding year's course group.
Literature	 - Grabe, J. (2004): Bodenmechanik und Grundbau, Band 3 der Veröffentlichungsreihe des Instituts für Geotechnik und Baubetrieb, Technische Universität Hamburg-Harburg. - Kolymbas, D. (2007): Geotechnik - Bodenmechanik, Grundbau und Tunnelbau. 2., korrigierte und ergänzte Auflage, Springer Verlag. - Normen zu geotechnischen Versuchsgeräten und Versuchsverfahren: - DIN 18135:2012-04: Baugrund, Untersuchung von Bodenproben - Eindimensionaler Kompressionsversuch, Deutsches Institut für Normung, e. V. - DIN 18137-2:2011-04: Baugrund, Untersuchung von Bodenproben - Bestimmung der Scherfestigkeit - Teil 2: Triaxialversuch, Deutsches Institut für Normung e. V.



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Description	n	
€ D	e challenging compolems can be identifure 56 Description Description Description Description Description Description Description	Description neering: Elective Compulsory ngineering: Elective Compulsory ering: Elective Compulsory



	Computational Science and Engineering: Specialisation Scientific Computing: Elective Compulsory
Assignment for the	Mechanical Engineering and Management: Specialisation Product Development and
Following Curricula	Production: Elective Compulsory
	Mechatronics: Specialisation System Design: Elective Compulsory
	Product Development, Materials and Production: Core qualification: Elective Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory
	Technomathematics: Core qualification: Elective Compulsory
	Theoretical Mechanical Engineering: Core qualification: Elective Compulsory
	Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0523: Bounda	ary Element Methods
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Otto von Estorff
Language	EN
Cycle	SoSe
Content	- Boundary value problems - Integral equations - Fundamental Solutions - Element formulations - Numerical integration - Solving systems of equations (statics, dynamics) - Special BEM formulations - Coupling of FEM and BEM - Hands-on Sessions (programming of BE routines) - Applications
Literature	Gaul, L.; Fiedler, Ch. (1997): Methode der Randelemente in Statik und Dynamik. Vieweg, Braunschweig, Wiesbaden Bathe, KJ. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin

Course L0524: Boundary Element Methods	
Тур	Recitation Section (large)
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Otto von Estorff
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Applied Groundwater Modeling (L0543) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Modeling of Water Supply and Sewer Network (L0875) Module Responsible NN Admission Requirements Groundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge on urban water infrastructures, in particular drinking water systemsar urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems • Basic knowledge on water management After taking part successfully, students have reached the following learning results Professional Competence The students are able to describe the modelling of groundwater flow and transport as well a urban water infrastructures. They can carry out systems analyses and can detect technical and transport as well and tra	Module M0827: M	Modeling in Water Management			
Applied Groundwater Modeling (L0543) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Addies a provided the project-fyroblem-based 2 3 Modeling of Water Supply and Sewer Network (L0875) Mone Requirements Coroundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge on urban water infrastructures, in particular drinking water systemsar urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems and S	Courses				
Module Responsible NN Admission Requirements Recommended Previous Knowledge Professional Competence Reducational Objectives Professional Competence Responsible From Students are able to describe the modelling of groundwater flow and transport as well a urban water infrastructures. They can carry out systems analyses and can detect technical are conceptual weak points within the systems in case studies. Besides they are able to analyst interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent They can work on different scenarios and can compare or assess different solutions fexisting problems by application of selected software products. The students are able to us different software solutions (e.g. EPANET, EPA-SWMM). Personal Competence Social Competence Autonomy Wird nicht vermittelt. Wird nicht vermittelt. Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Studienleistung None Examination Cral examination Cal examination C	Title Applied Groundwater Modeling (L0543) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Recitation Section (small) 2 2 Project-/problem-based 2 3			1 2	
Recommended Previous Knowledge Professional Competence Professional Competence Resource Knowledge Professional Competence Resource Knowledge The students are able to describe the modelling of groundwater flow and transport as well a urban water infrastructures. They can carry out systems analyses and can detect technical are conceptual weak points within the systems in case studies. Besides they are able to analyst interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent interdependencies of hydraulic and toxic phenomena in soil and water. Wird nicht vermittelt. Wird nicht vermittelt. Wird nicht vermittelt. Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Studienleistung None Examination duration and scale Zo min	Modulo Posponsiblo	ININ	Loariing		
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Competence The students are able to describe the modelling of groundwater flow and transport as well a urban water infrastructures. They can carry out systems analyses and can detect technical ar conceptual weak points within the systems in case studies. Besides they are able to analyse interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendently they can work on different scenarios and can compare or assess different solutions from existing problems by application of selected software products. The students are able to use different software solutions (e.g. EPANET, EPA-SWMM). Personal Competence Social Competence Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Studienleistung None Examination duration and scale The students are able to construct and apply scientific groundwater models indipendent flow and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent flow and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent flow and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent flow and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent flow and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater flow and scale to analyse flow and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater flow and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater flow and students. The students are able to construct and apply scientific groundwater flow and students. The students are able to construct and apply scientific groundwater. T		After taking part successfully, students have re	eached the following lea	rning resul	ts
They can work on different scenarios and can compare or assess different solutions for existing problems by application of selected software products. The students are able to us different software solutions (e.g. EPANET, EPA-SWMM). Personal Competence Social Competence Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Studienleistung Examination Oral exam Examination duration and scale They can work on different scenarios and can compare or assess different solutions for existing problems by application of selected software products. The students are able to us different software products are able to us different software products.	Competence	The students are able to describe the modelling of groundwater flow and transport as well as urban water infrastructures. They can carry out systems analyses and can detect technical and conceptual weak points within the systems in case studies. Besides they are able to analyse			
Competence Social Competence Autonomy Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Studienleistung None Examination Oral exam Examination duration and scale	Skills	They can work on different scenarios and existing problems by application of selected	can compare or assessoftware products. The	s different	solutions fo
Autonomy Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points 6 Studienleistung None Examination Ural exam Examination duration and scale	Competence	Wird nicht vermittelt.			
Credit points 6 Studienleistung None Examination Oral exam Examination duration and scale 20 min	·	Wird nicht vermittelt.			
Studienleistung None Examination Oral exam Examination duration and scale 20 min	Workload in Hours	Independent Study Time 110, Study Time in L	ecture 70		
Examination Oral exam Examination duration and scale 20 min	Credit points	6			
Examination duration and scale 20 min	Studienleistung	None			
and scale 20 min	Examination	Oral exam			
Civil Engineering: Specialisation Structural Engineering: Elective Compulsory		20 min			
Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory		· ·	-		у



Assignment for the Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Following Curricula Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory

Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0543: Applied Groundwater Modeling		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Sonja Schröter	
Language	DE/EN	
Cycle	SoSe	
Content	Introduction and application of the groundwater model MODFLOW (PMWIN); theoretical backround of the modell, students do work with the model PMWIN for practical case studies.	
Literature	MODFLOW-Handbuch Chiang, Wen Hsien: PMWIN	

Course L0544: Applied Groundwater Modeling	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Schröter
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0875: Modeling of Water Supply and Sewer Network		
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Klaus Johannsen, Weitere Mitarbeiter	
Language	DE	
Cycle	SoSe	
Content		
Literature	Mutschmann/Stimmelmayr: Taschenbuch der Wasserversorgung, 16. Auflage. Springer Vieweg - Verlag. Wiesbaden 2014.	



Courses				
Title Noise Protection (L1109)		Typ Lecture	Hrs/wk	CP 2
Urban Infrastructures (L0	874)	Project-/problem-based Learning	2	4
Module Responsible	Dr. Dorothea Rechtenbach			
Admission Requirements	None			
Recommended Previous Knowledge	 Knowledge on Urban planning Knowledge on measures for climat General knowledge of scientific write 	•		
Educational Objectives	After taking part successfully, students hav	e reached the following lea	ırning resul	ts
Professional Competence				
Knowledge	Students can describe urban development corridors as well as current and future urban environmental problems. They are able to explain the causes of environmental problems (like noise). Students can specify applications for various technical innovations and explain why these contribute to the improvement of urban life. They can, for example, derive and discuss measures for effective noise abatement.			
Skills	Students are able to develop specific solutions for correcting existing or future environment-related problems of urban development. They can define a range of conceptual and technical solutions for environmental problems for different development paths. To solve specific urban environmental problems they can select technical innovations and integrate them into the urban context.			
Personal Competence				
Social Competence	The students can work together in internat	onal groups.		
Autonomy	Students are able to organize their work flow to prepare themselves for presentations and contributions to the discussions. They can acquire appropriate knowledge by making enquiries independently.			
Workload in Hours	Independent Study Time 124, Study Time	n Lecture 56		
Credit points	6			
Studienleistung				
	Written elaboration			
Examination duration and scale	I Written Report bills oral Presentation			
Assignment for the Following Curricula				



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise I	Protection
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Jäschke
Language	EN
Cycle	SoSe
Content	
Literature	 Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) WHO (1999): Guidelines for Community Noise Environmental Noise Directive 2002/49/EG ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation

Course L0874: Urban Infrastructures	
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Dr. Dorothea Rechtenbach
Language	EN
Cycle	SoSe
Content	Problem Based Learning Main topics are: Central vs. Decentral Wastewater Treatment. Compaction of Cities. Car Free Cities. Multifunctional Places in Cities. The Sustainability of Freight Transport in Cities.
Literature	Depends on chosen topic.



Module M0859: C	Coastal Hydraulic Engineering II			
Courses				
Title		Тур	Hrs/wk	СР
Coastal- and Flood Protect		Lecture Project-/problem-based	2	3
Coastal- and Flood Protect		Learning	1	1
Maintennance and Defend	ce of Flood Protection Structures (L1411)	Lecture	2	2
Module Responsible	<u> </u>			
Admission Requirements	INONE			
Recommended Previous Knowledge	I (`cactal Engineering I			
Educational Objectives	Latter taking nart elicopeetiilly, etiidente hava	e reached the following lea	arning resul	Its
Professional Competence				
Knowledge	The students have the capability to define and explain in detail the important aspects or erosion protection and flood protection and are able to apply the aspects to practical coastal protection problems. They are able to design and dimension important coastal protection measures from the functional and from the constructional point of view.			
Skills	The students are able to select design approaches for the functional and constructional design of erosion and flood protection measures and apply these approaches to practical design tasks.			
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as the functional and constructive design of coastal and flood protection structures. Additionally, they will be able to work in team with engineers of other disciplines.			
Autonomy	The students will be able to independently extend their knowledge and apply it to new problems.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Studienleistung	None			
Examination	Written exam			
		The duration of the examination is 130 min. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.		
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory			



Course L0808: Coasta	II- and Flood Protection
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Other Concepst Calculation approaches and numerical models Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland
Literature	Vorlesungsumdruck Coastal Engineering Manual CEM

Course L1415: Coastal- and Flood Protection	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L1411: Mainter	Course L1411: Maintennance and Defence of Flood Protection Structures	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Olaf Müller	
Language	DE	
Cycle	SoSe	
Content	 Dike protection Maintennance of flood protection measures 	
Literature	Vorlesungsumdruck	



Module M0860: H	larbour Engineering and Hai	rbour Planning		
Courses				
Title Harbour Engineering (L08	09)	Typ Lecture	Hrs/wk 2	CP 2
Harbour Engineering (L14	14)	Project-/problem-based Learning	1	2
Port Planning and Port Co	nstruction (L0378)	Lecture	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of coastal engineering			
Educational Objectives	After taking part successfully, students	have reached the following lea	arning resu	lts
Professional Competence				
Knowledge	The students are able to define in details and to choose design approaches for the functional design of a port and apply them to design tasks. They can design the fundamental elements of a port.			
Skills	The students are able to select and apply appropriate approaches for the functional design of ports.			
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as the functional design of ports. Additionaly, they will be able to work in team with engineers of other disciplines.			
Autonomy	The students will be able to independently extend their knowledge and apply it to new problems.			
Workload in Hours	Independent Study Time 110, Study Tir	me in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 150 min. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.			
•	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory			



Course L0809: Harbou	ır Engineering
Тур	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	 Fundamentals of harbor engineering Maritime transportation and waterways engineering Ships Elements of harbors Harbor approaches and water-side harbor areas Terminal design and handling of cargo Quay-walls and piers Equipment of harbors Sluices and other special constructions Connection to inland transportation / inland waterway transportation Protection of harbors Breakwaters and Jetties Wave protection of harbors Fishery and other small harbors
Literature	Brinkmann, B.: Seehäfen, Springer 2005

Course L1414: Harbou	Course L1414: Harbour Engineering	
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0378: Port Planning and Port Construction		
Lecture		
2		
2		
Independent Study Time 32, Study Time in Lecture 28		
Frank Feindt		
DE		
SoSe		
 Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures Port of Hamburg - Infrastructure and development Preparation of areas Scour formation in front of shore structures 		
Vorlesungsumdruck, s. www.tu-harburg.de/gbt		



Courses				
Title		Тур	Hrs/wk	CP
Hydraulic Models (L0813)		Project-/problem-based Learning	1	1
Modelling of Waves (L081	2)	Project-/problem-based Learning	1	1
Modelling of Flow in River	s and Estuaries (L0810)	Lecture	3	4
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	INone			
Recommended Previous Knowledge	Coastal Hydraulic Engineering I			
Educational Objectives	LATTER TAKING NART SUCCESSIUM STUGENTS NAVE REACHED THE TOUGWING JEARNING RESULTS			
Professional Competence				
Knowledge	Students are able to define in detail the basic processes that are related to the modelling flows in hydraulic engineering. Besides, they can describe the basic aspects of numeric modelling and actual numerical models for the simulation of flows and waves.			
Skills	Students are able to apply hydrodynamic-numerical models to practical hydraulic engineerir tasks.			
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge in simple applied problems			
Autonomy	The students will be able to independently extend their knowledge and apply it to new problems.			
Workload in Hours	Independent Study Time 110, Study Tin	ne in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 3 hours. The examination includes tasks with respect to th general understanding of the lecture contents and calculations tasks.			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory			



Course L0813: Hydraulic Models	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	 Fundamentals of hydraulic models Model laws Pi theorem of Buckingham Practical examples of hydraulic models
Literature	Strobl, Zunic: Wasserbau, Kap. 11 Hydraulische Modelle, Springer

Course L0812: Modelling of Waves	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	 Waves, interactions with shallow water and constructions Wave theories Sea state and surges Development of waves Wave spectra Modelling of Waves / phase averaged and phase resolved models Application of a phase averaged model for wave prediction (SWAN) Application of phase resolved wave models (Mike)
Literature	Vorlesungsumdruck



Course L0810: Modelling of Flow in Rivers and Estuaries	
Typ Lecture	
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Dr. Edgar Nehlsen, Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	 classification of models model concept modelling 1D Working Equation Mathematical description of physical processes Equation of motions conservation of mass conservation of momentum Initial conditions and boundary conditions Numerical Methods Time step procedure Finite differences Finite volumes
Literature	Vorlesungsskript



Module M0874: \	Vastewater Systems			
Courses				
Title Wastewater Systems - C		Typ Lecture Recitation Section (large) Lecture Recitation Section (large)	2	CP 2 1 2 1
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	INONA			
Recommended Previous Knowledge	tua atma a at	Knowledge of wastewater management and the key processes involved in wastewate treatment.		
Educational Objectives	Latter taking part successfully students have re	eached the following lea	rning results	3
Professional Competence Knowledge	Students are able to outline key areas of the full range of treatment systems in waste water			
Skills	Students are able to pre-design and explain the available wastewater treatment processe and the scope of their application in municipal and for some industrial treatment plants.			
Personal Competence				
Social Competence	Social skills are not targeted in this module.			
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 96, Study Time in Le	cture 84		
Credit points	6			
Studienleistung	d .			
Examination	Written exam			
Examination duration and scale				
	Civil Engineering: Specialisation Structural Ercivil Engineering: Specialisation Geotechnical Civil Engineering: Specialisation Coastal Engineering: Specialisation Water and T Bioprocess Engineering: Specialisation Water and T Bioprocess Engineering: Specialisation A Compulsory Energy and Environmental Engineering: Specialisation Management and Engineering Engineering: Elective Compulsory International Management and Engineering Biotechnology: Elective Compulsory Process Engineering: Specialisation Encompulsory Process Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Specialisation Engineering: Specialisation Engineering: Specialisation Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Spec	al Engineering: Elective of ineering: Elective Compineering: Elective Compineering: Elective Compineering: Compulsory - General Bioprocess ecialisation Environment g: Specialisation II. Encountry vironmental Process Engineering: Elective Calisation Water: Compul	Compulsory bulsory bulsory see Engineeri tal Engineeri ergy and Er cocess Engineerir ompulsory sory	ng: Elective ring: Elective nvironmenta neering and ng: Elective



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Wastewater Systems - Collection, Treatment and Reuse		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Ralf Otterpohl	
Language	EN	
Cycle	SoSe	
Content	 •Understanding the global situation with water and wastewater •Regional planning and decentralised systems •Overview on innovative approaches •In depth knowledge on advanced wastewater treatment options for different situations, for end-of-pipe and reuse •Mathematical Modelling of Nitrogen Removal •Exercises with calculations and design 	
Literature	Henze, Mogens: Wastewater Treatment: Biological and Chemical Processes, Springer 2002, 430 pages George Tchobanoglous, Franklin L. Burton, H. David Stensel: Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy McGraw-Hill, 2004 - 1819 pages	

Course L0943: Wastewater Systems - Collection, Treatment and Reuse	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0357: Advanced Wastewater Treatment		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Joachim Behrendt	
Language	DE	
Cycle	SoSe	
	Survey on advanced wastewater treatment	
	reuse of reclaimed municipal wastewater	
	Precipitation	
	Flocculation	
	Depth filtration	
Content	Membrane Processes	
	Activated carbon adsorption	
	Ozonation	
	"Advanced Oxidation Processes"	
	Disinfection	
	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003	
	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987	
Literature	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007	
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006	
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003	



Course L0358: Advanced Wastewater Treatment		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Joachim Behrendt	
Language	DE	
Cycle	SoSe	
	Aggregate organic compounds (sum parameters)	
	Industrial wastewater	
	Processes for industrial wastewater treatment	
	Precipitation	
Content	Flocculation	
	Activated carbon adsorption	
	Recalcitrant organic compounds	
	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003	
	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987	
Literature	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007	
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006	
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003	



Courses				
Fitle City Planning (L1066)		Typ Project-/problem-based Learning	Hrs/wk	CP 6
Module Responsible	Prof. Carsten Gertz			
Admission Requirements				
	for "Principles of Urban Planning": none for "Designing Urban Streetscapes": some taking the undergraduate class "Transport Pla	-		, e.g. throug
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning resul	ts
Professional Competence				
Knowledge	 Students are able to: use technical terms of urban planning. describe the main determinants of urban development. explain and compare different possibilities of how urban development can be influenced. discuss requirements for public streetscapes. explain the importance of street design. 			
Skills	 students are able to: read and analyze urban development concepts and designs for streetscapes appraise such concepts in the context of competing requirements. design, justify and reflect their own solutions for concrete examples. 			
Personal Competence	Students are able to:			
Social Competence	 discuss intermediate results with each constructively accept feedback on their provide constructive feedback to other 	r own work.		
Autonomy	 Students are able to: independently complete a written report including drawings following a broadly predefined process. assess the consequences of their proposed solutions. independently acquire knowledge and apply this to new issues or problem areas. 			
	Independent Study Time 124, Study Time in L			



Credit points	6
Studienleistung	None
Examination	Written elaboration
Examination duration and scale	I written assignment, designwork during the semester
Assignment for the Following Curricula	H odistics intrastructure and Mobility. Specialisation intrastructure and Mobility. Electivel

Course L1066: City Planning		
Typ Project-/problem-based Learning		
Hrs/wk	4	
СР	6	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Lecturer	Prof. Carsten Gertz	
Language	DE	
Cycle	SoSe	
Content	"Principles of Urban Planning" deals with the determinants of urban development and their interactions. Topics include: • legal framework, • instruments and methods of planning, • functional requirements, • stakeholders and actors • basic design requirements • different planning levels and • historical contexts. The objective of the course is for students to acquire a basic understanding of urban development problems and approaches for solving them. They will also be able to comprehend the process of urban planning. The course also covers the various functional and aesthetic requirements for designing streetscape as the most important elements of public space. The project work deals with a real life scenario and includes drawing up a development plan, an urban design concept, a building masterplan and a street redesign.	
Literature	Albers, Gerd; Wekel, Julian (2009) Stadtplanung: Eine illustrierte Einführung. Primus Verlag. Darmstadt. Frick, Dieter (2008) Theorie des Städtebaus: Zur baulich-räumlichen Organisation von Stadt. Wasmuth-Verlag. Tübingen Jonas, Carsten (2009) Die Stadt und ihr Grundriss. Wasmuth-Verlag. Tübingen Kostof, Spiro; Castillo, Greg (1998) Die Anatomie der Stadt. Geschichte städtischer Strukturen. Campus-Verlag. Frankfurt/New York.	



Module M0977: C	Construction Logistics and Pr	oject Management		
Courses				
Title Construction Logistics (L1163) Construction Logistics (L1164) Project Development and Management (L1161)		Typ Lecture Recitation Section (small) Lecture	Hrs/wk 1 1	CP 2 2 1
Project Development and	Management (L1162)	Project-/problem-based Learning	1	1
Module Responsible	,			
Admission Requirements	None			
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, students h	ave reached the following lea	rning resu	lts
Professional Competence				
Knowledge	 give definitions of the main terms of construction logistics and project development and management name advantages and disadvantages of internal or external construction logistics explain characteristics of products, demand and production of construction objects and their consequences for construction specific supply chains differentiate constructions logistics from other logistics systems 			
Skills	carry out project life cycle assess apply methods and instruments of design supply and waste removal	of construction logistics of project development and ma of conflict management		ıt
Personal Competence				
Social Competence	 hold presentations in and for gro apply methods of conflict solving 	•	studies	
Autonomy	solve problems by holistic, system improve their creativity, negotiation methods of moderation in case s	on skills, conflict and crises so	olution ski	lls by applying
	Independent Study Time 124, Study Tim	e in Lecture 56		
Credit points				
Studienleistung				
Examination duration	Written elaboration Two written papers with presentations			
and scale	Civil Engineering: Specialisation Structu	ıral Engineering: Elective Com	npulsory	
	[63]			



	Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory
Assignment for the	International Management and Engineering: Specialisation II. Civil Engineering: Elective
Following Curricula	Compulsory
	International Management and Engineering: Specialisation II. Logistics: Elective Compulsory
	Logistics, Infrastructure and Mobility: Specialisation Production and Logistics: Elective
	Compulsory
	Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective
	Compulsory

Course L1163: Construction Logistics		
Тур	Lecture	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Heike Flämig	
Language	DE	
Cycle	SoSe	
Content	The lecture gives deeper insight how important logistics are as a competetive factor for construction projects and which issues are to be adressed. The following toppics are covered: • competetive factor logistics • the concept of systems, planning and coordination of logistics • material, equipment and reverse logistics • IT in construction logistics	
Literature	Contents of the lecture are deepened in special exercises. Flämig, Heike: Produktionslogistik in Stadtregionen. In: Forschungsverbund Ökologische Mobilität (Hrsg.) Forschungsbericht Bd. 15.2. Wuppertal 2000. Krauss, Siri: Die Baulogistik in der schlüsselfertigen Ausführung, Bauwerk Verlag GmbH Berlin 2005. Lipsmeier, Klaus: Abfallkennzahlen für Neubauleistungen im Hochbau: Verlag Forum für Abfallwirtschaft und Altlasten, 2004. Schmidt, Norbert: Wettbewerbsfaktor Baulogistik. Neue Wertschöpfungspotenziale in der Baustoffversorgung. In: Klaus, Peter: Edition Logistik. Band 6. Deutscher Verkehrs-Verlag. Hamburg 2003. Seemann, Y.F. (2007): Logistikkoordination als Organisationseinheit bei der Bauausführung Wissenschaftsverlag Mainz in Aachen, Aachen. (Mitteilungen aus dem Fachgebiet Baubetrieb und Bauwirtschaft (Hrsg. Kuhne, V.): Heft 20)	



Course L1164: Construction Logistics	
Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heike Flämig
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1161: Project	Development and Management
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei
Language	DE
Cycle	SoSe
Content	 Within the lecture, the main aspects of project development and management are tought: Terms and definitions of project management Advantages and disadvantages of different ways of project handling organization, information, coordination and documentation cost and fincance management in projects time- and capacity management in projects specific methods and instruments for successful team work Contents of the lecture are deepened in special exercises.
Literature	Projektmanagement-Fachmann. Band 1 und Band 2. RKW-Verlag, Eschborn, 2004.

Course L1162: Project Development and Management	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0998: S	Statics and Dynamics of Structure	s		
Courses				
Title Structural Dynamics (L12 Structural Dynamics (L12 Fracture mechanics and fracture Mec	03) fatigue in steel structures (L0564)	Typ Lecture Recitation Section (large) Lecture Recitation Section (large)	1	CP 2 2 1
Module Responsible		(0 /		
Admission Requirements				
Recommended Previous Knowledge	Knowledge of linear structural analysis of stat Mechanics I/II, Mathematics I/II, Differential equ	•	indetermina	te structures;
Educational Objectives	After taking part successfully, students have re	ached the following lea	rning result	S
Professional Competence		•	in the basi	c aspects of
Knowledge Skills	After successful completion of this module, the material and structures to dynamics loading u and methods.		•	
Personal Competence				
Social Competence	participate in subject-specific and interest defend their own work results in front o promote the scientific development of continuous furthermore, they can give and accept	f others colleagues		
Autonomy	Students are able to gain knowledge of the apply it to new problems. Furthermore, they problems in the area of Structural Analysis.			
Workload in Hours	Independent Study Time 96, Study Time in Led	cture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	150 min			
Assignment for the	Civil Engineering: Specialisation Structural En Civil Engineering: Specialisation Geotechnica Civil Engineering: Specialisation Coastal Engi	l Engineering: Elective (,



Following Curricula	g Curricula Civil Engineering: Specialisation Water and Traffic: Elective Compulsory		
	International Management and Engineering: Specialisation II. Civil Engineering: Elective		
	Compulsory		

Course L1202: Structural Dynamics		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	SoSe	
Content	 Single-degree-of-freedom systems: undamped and damped vibration, free vibration, forced vibrations due to harmonic, periodical or arbitrary loading, natural frequency, damping vibration isolation solution in the frequency-domain (Fourier transformation), solution in the time-domain multi-degree-of-freedom systems: continuous or discrete systems, modelling with finite elements, generalisation modal analysis power iteration according to v.Mises earthquake loading: seismological basics, response spectrum method wind-induced vibrations: engineering meteorology, aerodynamic, classification of excitation mechanisms progressive collapse	
Literature	Clough, R.W., Penzien, J.: Dynamics of Structures. 2. Aufl., McGraw-Hill, New York, 1993.	

Course L1203: Structural Dynamics	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



avT	Lecture
Hrs/wk	
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Ingo Hadrych
Language	DE
Cycle	SoSe
	basics of fatigue stress and fatigue resistance and determination of fatigue strength,
	· determination anduse of S-N-curves and classification of notch effects,
	 set up of determination of fatigue strength under dynamic load using the accumulat formula by Palmgren-Miner,
Content	set up of determination of fatigue strength in different examples,
	basics of construction and design regarding the problem of material fatigue,
	basics of linear elastic fracture mechanics under static and dynamic load,
	 determination of lifetime of steel construction based on linear elastic fracture mechanics different examples.
	 Seeßelberg, C.; Kranbahnen - Bemessung und konstruktive Gestaltung; 3. Auflage; Bauwerk-Verlag; Berlin 2009
	 Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 20 Verlag Ernst & Sohn; Berlin 2003
	 Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Aufla Stahlbau-Verlagsgesellschaft; Köln 1996
	Petersen, C.; Stahlbau; 3. überarb. und erw. Auflage; Vieweg-Verlag; Braunschweig 199
	DIN V ENV 1993-1-1: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; 1-1: Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993
	DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Tei Kranbahnen; 2001
Literature	 DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; Nationa Anwendungsdokument (NAD); Berlin 2002



Course L0565: Fracture Mechanics and Fatigue	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Ingo Hadrych
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0999: S	Steel Construction Pro	oject			
Courses					
Title Steel Construction Projec	t (L1206)	Typ Project Sei	minar	Hrs/wk	CP 6
Module Responsible	Prof. Marcus Rutner				
Admission Requirements	INONA				
Recommended Previous Knowledge	I STORE AND L'AMNOGUE STRUCTUR	res			
Educational Objectives	I ATTOR TOKING NORT CHACCECTURY	students have reached the	following lea	rning resul	ts
Professional Competence					
Knowledge	Students are able to prepare a part of the whole project and explain it to the others.				
Skills	Students can produce sketch adjust their work in reaction project.			•	•
Personal Competence					
	Students can present their re-	sults to other members of th	ie group.		
Social Competence	They have the ability to work	for a broad agreement with	respect to inte	ergroup de	pendencies.
	They can distribute and proce	ess tasks independently.			
Autonomy	Students can handle their pa	rt of the project on their owr	resposibility-		
Workload in Hours	Independent Study Time 124	, Study Time in Lecture 56			
Credit points	6				
Studienleistung	None				
Examination	Written elaboration				
Examination duration and scale	Lapprox 15-20 pages (without	t appendix)			
Assignment for the Following Curricula	Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Structural Engineering: Compulsory				

Course L1206: Steel Construction Project		
Тур	Project Seminar	
Hrs/wk	4	
СР	6	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Lecturer	Prof. Marcus Rutner	
Language	DE	
Cycle	SoSe	
Content	Design of a big construction project (i.e skyscraper, large bridge, roof of a stadiuim) in small groups	
Literature	Wird je nach Projekt individuell angegeben.	



Module M0663: N	Marine Geotechnics and Numeric	s		
Courses				
Title Marine Geotechnics (L0548) Marine Geotechnics (L0549) Numerical Methods in Geotechnics (L0375)		Typ Lecture Recitation Section (large) Lecture	Hrs/wk 1 1 3	CP 2 1 3
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements				
Recommended Previous Knowledge	complete modules: Geotechnics I-II, Mathematicourses: Soil laboratory course	atics I-III		
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence Knowledge				
Skills Personal Competence Social Competence				
Autonomy	Independent Study Time 110, Study Time in	Lacture 70		
Credit points		Leciule / U		
Studienleistung				
	Written exam			
Examination duration and scale	90 min			
Assignment for the Following Curricula	I Compilieon/			



Course L0548: Marine Geotechnics		
Тур	Lecture	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Lecturer Prof. Jürgen Grabe	
Language	DE	
Cycle	SoSe	
Content	 Geotechnical investigation an description of the seabed Foundations of Offshore-Constructions cCliff erosion Sea dikes Port structures Flood protection structures 	
Literature	 EAK (2002): Empfehlungen für Küstenschutzbauwerke EAU (2004): Empfehlungen des Arbeitsausschusses Uferbauwerke Poulos H.G. (1988): Marine Geotechnics. Unwin Hyman, London Wagner P. (1990): Meerestechnik: Eine Einführung für Bauingenieure. Ernst & Sohn, Berlin 	

Course L0549: Marine Geotechnics	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0375: Numerical Methods in Geotechnics		
Тур	Lecture	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Dr. Hans Mathäus Stanford	
Language	DE	
Cycle	SoSe	
Content	Topics: numerical simulations numerical algorithms finite element method application of finite element method in geomechanics constitutive models for soils contact models for soil structure interaction selected applications	
Literature	 Wriggers P. (2001): Nichtlineare Finite-Elemente-Methoden, Springer Verlag, Berlin Bathe Klaus-Jürgen (2002): Finite-Elemente-Methoden. Springer Verlag, Berlin 	



Modulo M0591. W	Vator Protoction			
Module M0581: V	valer Protection			
Courses				
Title Water Protection and Was	stewater Management (L0226)	Typ Lecture	Hrs/wk 3	CP 3
	stewater Management (L2008)	Project Seminar	3	3
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	None			
Recommended Previous Knowledge	 Good knowledge of wastewa 	rainage;	and their prope	rties;
Educational Objectives	After taking part successfully, studer	nts have reached the followin	g learning resu	lts
Professional Competence				
Knowledge	The students can describe the basic principles of the regulatory framework related to the international and European water sector. They can explain limnological processes, substance cycles and water morphology in detail. They are able to assess complex problems related to water protection, such as ecosystem service and wastewater treatment with a special focus on innovative solutions, remediation measures as well as conceptual approaches.			
Skills	Students can accurately assess cur context. They can suggest concrete water cycle. Furthermore, they collegislative solutions to solve these parts.	e actions to contribute to the potential actions to contribute to the potential actions.	planning of tom	norrow's urban
Personal Competence	The students can work together in ir	nternational groups		
Social Competence	-	nomational groups.		
Autonomy	Students are able to organize their can acquire appropriate knowledge			cussions. They
Workload in Hours	Independent Study Time 96, Study	Fime in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	60 min			



Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L0226: Water I	Protection and Wastewater Management
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 Regulatory Framework (e.g. WFD) Main instruments for the water management and protection In depth knowledge of relevant measures of water pollution control Urban drainage, treatment options in different regions on the world Rainwater management, improved management of heavy rainfalls, downpours, rainwater harvesting, rainwater infiltration Case Studies and Field Trips
Literature	 The literature listed below is available in the library of the TUHH. Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International. Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011) New York, NY: McGraw-Hill. Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Course L2008: Water I	Course L2008: Water Protection and Wastewater Management		
Тур	Project Seminar		
Hrs/wk	3		
СР	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Lecturer	Prof. Ralf Otterpohl		
Language	EN		
Cycle	WiSe		
Content			
Literature			



Examination of Materials, Struc	tural Condition	and Damage	es
Structural Condition and Damages (L0260) Structural Condition and Damages (L0261)	Typ Lecture Recitation Section	Hrs/wk 4 (small) 1	CP 4 2
Prof. Frank Schmidt-Döhl			
None			
		e, for example b	by the module
After taking part successfully, students ha	ve reached the followi	ng learning resu	lts
The students are able to describe the rules for trading, use and marking of construction products in Germany. They know which methods for the testing of building material properties are usable and know the limitations and characterics of the most important testing methods.			
The students are able to responsibly discover the rules for trading and using of building products in Germany. They are able to chose suitable methods for the testing and inspection of construction products, the examination of damages and the examination of the structural conditions of buildings. They are able to conclude from symptons to the cause of damages. They are able to describe an examination in form of a test report or expert opinion.			
The students can describe the different roles of manufacturers as well as testing, supervisory and certification bodies within the framework of material testing. They can describe the different roles of the participants in legal proceedings.			
The students are able to make the tim knowledge of a very extensive field.	ing and the operation	steps to learn	the specialist
Independent Study Time 110, Study Time	in Lecture 70		
6			
None			
Written exam			
120 min			
Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Materials Science: Specialisation Engineering Materials: Elective Compulsory			
	Structural Condition and Damages (L0260) Structural Condition and Damages (L0261) Prof. Frank Schmidt-Döhl None Basic knowledge about building materia Building Materials and Building Chemistr After taking part successfully, students had the products in Germany. They know which rare usable and know the limitations and of products in Germany. They are able to responsibly deproducts, the examination of damages buildings. They are able to conclude from to describe an examination in form of a text of the participants in legal participants in legal participants. The students are able to make the time knowledge of a very extensive field. Independent Study Time 110, Study Time 6 None Written exam 120 min Civil Engineering: Specialisation Geotect Civil Engineering: Specialisation Water a International Management and Engineer Compulsory	Structural Condition and Damages (L0260) Structural Condition and Damages (L0261) Prof. Frank Schmidt-Döhl None Basic knowledge about building materials or material science Building Materials and Building Chemistry. After taking part successfully, students have reached the following results are able to describe the rules for trading, use products in Germany. They know which methods for the testing are usable and know the limitations and characterics of the most The students are able to responsibly discover the rules for products in Germany. They are able to chose suitable methods for the testing a products, the examination of damages and the examination buildings. They are able to conclude from symptons to the cau to describe an examination in form of a test report or expert opic to describe an examination in form of a test report or expert opic filterent roles of the participants in legal proceedings. The students are able to make the timing and the operation knowledge of a very extensive field. Independent Study Time 110, Study Time in Lecture 70 Mone Written exam 120 min Civil Engineering: Specialisation Structural Engineering: Elective Civil Engineering: Specialisation Coastal Engineering: Elective Civil Engineering: Specialisation Water and Traffic: Elective Cormulational Management and Engineering: Specialisation Compulsory	Structural Condition and Damages (L0260) Structural Condition and Damages (L0261) Prof. Frank Schmidt-Döhl None Basic knowledge about building materials or material science, for example to Building Materials and Building Chemistry. After taking part successfully, students have reached the following learning results are able to describe the rules for trading, use and marking of products in Germany. They know which methods for the testing of building materials are usable and know the limitations and characterics of the most important testing. The students are able to responsibly discover the rules for trading and usi products in Germany. They are able to chose suitable methods for the testing and inspection of damages and the examination of the structural buildings. They are able to conclude from symptons to the cause of damages. to describe an examination in form of a test report or expert opinion. The students can describe the different roles of manufacturers as well as testing and certification bodies within the framework of material testing. They can different roles of the participants in legal proceedings. The students are able to make the timing and the operation steps to learn knowledge of a very extensive field. Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 120 min Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation III. Civil Engineering: Specialisation III. Civil Engineering: Specialisation III.



Course L0260: Examir	ourse L0260: Examination of Materials, Structural Condition and Damages		
Тур	Lecture		
Hrs/wk	4		
СР	4		
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56		
Lecturer	Prof. Frank Schmidt-Döhl		
Language	DE		
Cycle	WiSe		
Content	Materials testing and marking process of construction products, testing methods for building materials and structures, testing reports and expert opinions, describing the condition of a structure, from symptons to the cause of damages		
Literature	Frank Schmidt-Döhl: Materialprüfung im Bauwesen. Fraunhofer irb-Verlag, Stuttgart, 2013.		

Course L0261: Examir	Course L0261: Examination of Materials, Structural Condition and Damages		
Тур	Recitation Section (small)		
Hrs/wk	1		
СР	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Frank Schmidt-Döhl		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M1350: E	Excavation Law and Projects			
	<u> </u>			
Courses				
Title		Тур	Hrs/wk	CP
Subsoil and Underground		Lecture	2	2
Service Contract and Pro	curement Law (L1906)	Lecture	2	2
Project Geotechnics (L07	(08)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional				
Competence				
Knowledge				
Skills				
Personal				
Competence				
Social Competence				
Autonomy				
	Independent Study Time 96, Study Time in	Lecture 84		
Credit points				
Studienleistung				
Examination	Oral exam			
Examination duration and scale	15 min			
Assignment for the Following Curricula	Civil Engineering: Specialisation Coastal E Civil Engineering: Specialisation Geotechr Civil Engineering: Specialisation Structura Civil Engineering: Specialisation Water an	nical Engineering: Elective I Engineering: Elective Co	Compulson mpulsory	ry



Course L0395: Subsoi	l and Underground Engineering Law
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Georg-Friedger Drewsen
Language	DE
Cycle	WiSe
Content	 Introduction Historical Overview Areas of civil law The Contracting Parties Authorities, Cooperatioves and other patries involved The Civil law The Public Service Obligations Land acquisition Planning of underground construction projects The construction contract according to BGB/VOB - design and implementation The civil law in the jurisdiction
Literature	Folienskipt (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner- Verlag

Course L1906: Service	ourse L1906: Service Contract and Procurement Law		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Günther Schalk, Prof. Jürgen Grabe		
Language	DE		
Cycle	WiSe		
Content			
Literature			



Course L0708: Project	Geotechnics
Тур	Project-/problem-based Learning
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	The students solve independently a project-based geotechnical problem in groups. Additional lectures concerning the problem will be held and material will be distributed as study basis. Every two weeks the groups present their current project status. The final work will be presentated in a final presentation.
Literature	abhängig von der Fragestellung



Courses					
Title Waste and Environmental	Chemistry (L0328)		Typ Practical Course	Hrs/wk 2	CP 2
Biological Waste Treatme	nt (L0318)		Project-/problem-based Learning	3	4
Module Responsible	Prof. Kerstin Kuchta				
Admission Requirements	None				
Recommended Previous Knowledge	chemical and biological b	basics			
Educational Objectives	After taking part successf	fully, students have re	ached the following lea	ırning resul	ts
Professional Competence					
Knowledge	The module aims possess knowledge concerning the planning of biological waste treatment plants. Students are able to explain the design and layout of anaerobic and aerobic waste treatment plants in detail, describe different techniques for waste gas treatment plants for biological waste treatment plants and explain different methods for waste analytics.				
Skills	The students are able to discuss the compilation of design and layout of plants. They can critically evaluate techniques and quality control measurements. The students can recherche and evaluate literature and date connected to the tasks given in der module and plan additional tests. They are capable of reflecting and evaluating findings in the group.				
Personal Competence	<u> </u>	to in cubiact specifi	o and interdicciplinar	v discussi	ons dovolo
Social Competence	Students can participate in subject-specific and interdisciplinary discussions, develop cooperated solutions and defend their own work results in front of others and promote the scientific development in front of colleagues. Furthermore, they can give and accept professional constructive criticism.				
Autonomy	Students can independently tap knowledge from literature, business or test reports and transform it to the course projects. They are capable, in consultation with supervisors as well as in the interim presentation, to assess their learning level and define further steps on this basis. Furthermore, they can define targets for new application-or research-oriented duties in accordance with the potential social, economic and cultural impact.				
Workload in Hours	Independent Study Time	110, Study Time in Le	ecture 70		
Credit points	6				
Studienleistung	Compulsory Bonus Yes None	Form Subject theoret	Descriptio ical and	on	
Proportion		practical work			
	Presentation				
Examination duration					



Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Core qualification: Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Energy: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory
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Course L0328: Waste and Environmental Chemistry		
Тур	Practical Course	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Kerstin Kuchta	
Language	DE/EN	
Cycle	WiSe	
Content	The participants are divided into groups. Each group prepares a transcript on the experiment performed, which is then used as basis for discussing the results and to evaluate the performance of the group and the individual student. In some experiments the test procedure and the results are presented in seminar form, accompanied by discussion and results evaluation. Experiments ar e.g. Screening and particle size determination Fos/Tac AAS Chalorific value	
Literature	Scripte	



Course L0318: Biological Waste Treatment			
Тур	Project-/problem-based Learning		
Hrs/wk	3		
СР	4		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42		
Lecturer	Prof. Kerstin Kuchta		
Language	EN		
Cycle	WiSe		
Content	 Introduction biological basics determination process specific material characterization aerobic degradation (Composting, stabilization) anaerobic degradation (Biogas production, fermentation) Technical layout and process design Flue gas treatment Plant design practical phase 		
Literature			



Module M0705: 0	Groundwater			
Courses				
Title Geohydraulic and Solute Geohydraulic and Solute Simulation in Groundwate	Transport (L0540)	Typ Lecture Recitation Section (small) Lecture	Hrs/wk 2 1	CP 2 1
Simulation in Groundwate	r Hydrology (L0542)	Recitation Section (small)	2	2
Module Responsible	NN			
Admission Requirements	None			
Recommended Previous Knowledge	11/4101110011411100			
Educational Objectives	I Affer taking nart successfully, students have re	eached the following lea	rning results	
Professional Competence				
Knowledge	The students are able to describe the fate of solutes in the subsurface along the path between soil and water body quantitatively and qualitatively. They are able to do this with simulation models.			
Skills	The students are able to describe conceptually movement and storage of water in the unsaturated zone. They are able to analyse pF- functions and Ku functions. They can model transport of solutes in the unsaturated and saturated zoned. They are able to determine dispersiities, sorption coefficients, decay rates and dissolution rates for organic and inorganic substances.			
Personal Competence				
Social Competence	The students can help to each other.			
Autonomy				-
-	Independent Study Time 96, Study Time in Le	cture 84		
Credit points				
Studienleistung	None Written exam			
Examination duration and scale	60 min written exam and written papers			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Encivil Engineering: Specialisation Geotechnical Civil Engineering: Specialisation Coastal Engineering: Specialisation Water and Theoress Engineering: Specialisation Encompulsory Process Engineering: Specialisation Process Water and Environmental Engineering: Process Proc	al Engineering: Elective (ineering: Elective Comp raffic: Elective Compulso vironmental Process Engineering: Elective Calisation Water: Compulsation Environment: E	Compulsory pulsory pry Engineerin ompulsory sory	oulsory



Course L0539: Geohy	draulic and Solute Transport	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Wilfried Schneider	
Language	DE	
Cycle	WiSe	
Content	Pump test analysis, water content-water suction functions, unsaturated hydraulic conductivity function, Brooks-Corey relation, van Genuchten relation, solute transport in unsaturated zone, solute transport and reactions in groundwater	
Literature	Todd; K. (2005): Groundwater Hydrology Fetter, C.W. (2001): Applied Hydrogeology Hölting & Coldewey (2005): Hydrogeologie Charbeneau, R.J. (2000): Groundwater Hydraulics and pollutant Transport	

Course L0540: Geohydraulic and Solute Transport		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wilfried Schneider	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0541: Simulation in Groundwater Hydrology		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Sonja Schröter	
Language	DE	
Cycle	WiSe	
Content	Basics and theoretical background of simulation models frequently used in science and practise for pumping test analysis, water movement in vadose zone, solute transport in vadose zone, groundwater recharge, solute transport in groundwater	
Literature	Handbücher der verwendeten Slumationsmodelle werden bereitgestellt.	



Course L0542: Simulation in Groundwater Hydrology		
Тур	Recitation Section (small)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Sonja Schröter	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0713: C	Concrete Structures			
Courses				
Title		Тур	Hrs/wk	СР
Concrete Structures (L05	79)	Seminar	1	1
Structural Concrete Memb	,	Lecture	2	3
Structural Concrete Members (L0578) Recitation Section (large) 2 2			2	
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
		nception and dimensioning of structur	al concrete	
Recommended Previous Knowledge	Modules 'Concrete Structures I a	and II'		
Educational Objectives	After taking part successfully, stu	udents have reached the following lea	ırning resu	Its
Professional Competence				
Knowledge	The students broaden their skills in structural engineering, especially in the field of building (houses, roofs, halls). They dispose of the knowledge for the conception and design concrete buildings and structural members that are often used.			
Skills	The students are able to apply procedures of the conception and dimensioning to to practical problems of structural engineering. They are capable to draft concrete buildings and to design them for general action effects and to plan their detailing and execution. Moreover, they can make design and construction sketches and draw up technical descriptions.			
Personal				
Competence				
Social Competence	The students are able to obtain	results of high quality in teamwork.		
Autonomy	The students are able to carry out complex conception and dimensioning tasks of structures under the guidance of tutors.			
Workload in Hours	Independent Study Time 110, S	tudy Time in Lecture 70		
Credit points	6			
Studienleistung				
	Written exam			
Examination duration and scale	120 minutes			
_	Civil Engineering: Specialisation Structural Engineering: Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective			

Compulsory



Course L0579: Concrete Structures		
Тур	Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	With help of a project teamwork the subjects of the course "Concrete Structures" is practiced, discussed and presented.	
Literature	- Projektbezogene Unterlagen werden abgegeben.	

Course L0577: Structural Concrete Members			
Тур	Lecture		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Günter Rombach		
Language	DE		
Cycle	WiSe		
Content	 concrete buildings actions on structrues bracing systems slabs (line and point supported plates and floor slabs) membranes and deep beams shells and folded plates reinforced and prestressed members 		
Literature	- Vorlesungsunterlagen		

Course L0578: Structural Concrete Members		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0722: C	Computational Analysis of Co	oncrete Structures		
Courses				
Title		Тур	Hrs/wk	СР
•	f Concrete Structures (L0598)	Lecture	2	2
Computational Analysis of	f Concrete Structures (L0599)	Recitation Section (large)	2	2
FE-Modeling of Concrete	Structures (L0600)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
	Basic knowledge in structural analysis slabs, shear walls).	s and design of reinforced con	crete struc	ctures (beams,
	·			
Recommended	Lectures 'Concrete Structures I und II'			
Previous Knowledge	Lectures 'Structural Analysis I and II'			
	Lecture 'Concrete Structures'			
	Lecture Concrete Structures			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional				
Competence				
Knowledge	The students know the problems of numerical modeling and design of an arbitrary concrete structure.			
Skills	The students can model and design an arbitrary concrete structure by means of a finite element software package.			
Personal				
Competence				
Social Competence	The students can model and design in element software package.	teamwork a real concrete struc	cture by m	eans of a finite
Autonomy	The students can model and design software package and discuss the prob			finite element
Workload in Hours	Independent Study Time 96, Study Tim	ne in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Oral exam			
Examination duration and scale	45 min			
_	Civil Engineering: Specialisation Struc Civil Engineering: Specialisation Geote Civil Engineering: Specialisation Coas Civil Engineering: Specialisation Wate	echnical Engineering: Elective (stal Engineering: Elective Comp	Compulso oulsory	ry



Course L0598: Computational Analysis of Concrete Structures	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 Modeling of beam and truss structures Discontinuity regions, like frame corners, openings, shear walls with large openings Bracing of high-rise buildings Modeling of bridges Nonlinear analysis Finite-Elemente-analysis of slabs: support conditions, singularity regions Finite-Elemente-Berechnungen of shear walls and deep beams: support condition, design Coupled systems Modeling of slab supported on beams Shell structures 3D building models Nonlinear analysis of slabs and shells Documentation
Literature	 Vorlesungsumdruck Rombach, G.A. (2007): Anwendung der Finite-Elemente-Methode im Betonbau. 2. Auflage, Verlag Ernst & Sohn, Berlin Rombach G.A. (2011): Finite-Element Design of Concrete Structures, 2nd edition, ICE publishing Hartmann, F., Katz, C. (2002): Statik mit finiten Elementen. Springer, Berlin

Course L0599: Computational Analysis of Concrete Structures	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L0600: FE-Mod	deling of Concrete Structures
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Lukas Henze
Language	DE
Cycle	WiSe
Content	Finite Element Modeling and computational design of concrete structures by 'SOFiSTiK'
Literature	 Rombach G.: Anwendung der Finite - Elemente - Methode im Betonbau. 2. Auflage. Verlag Ernst &.Sohn, Berlin, 2007 Rombach G.: Finite-Element Design of Concrete Structures. 2nd edition, ICE Publishing, London, 2011, ISBN 0 7277 32749 Rombach G.: EDV-unterstützte Berechnungen im Stahlbetonbau. in: "Stahlbetonbau aktuell 2014" (ed. Gorris A., Hegger J., Mark P.), Berlin 2014 (S. C1C.36)



Module M0801: V	Vater Resources and -Supply			
Courses				
Title		Тур	Hrs/wk	СР
Chemistry of Drinking Wa		Lecture	2	1
Chemistry of Drinking Wa	,	Recitation Section (large)		2
Water Resource Manager Water Resource Manager	,	Lecture	2	2 1
	· · · · · · · · · · · · · · · · · · ·	Recitation Section (small)	1	ı
Module Responsible Admission				
Requirements	None			
Previous Knowledge	Knowledge of water management and the	key processes involved in v	water treat	ment.
Educational Objectives	After taking part successfully, students hav	e reached the following lea	rning resu	lts
Professional Competence				
Competence	Students will be able to outline key area	s of conflict in water mana	dement a	s well as their
Knowledge	mutual dependence for sustainable water environmental and social factors. Studiorganisational structures of water companity treatment processes and the scope of their	r supply. They will unders dents will be able to e: ies. They will be able to ex	tand relev xplain and	ant economic d outline the
Skills	Students will be able to assess complex problems in drinking water production and establish solutions involving water management and technical measures. They will be able to assess the evaluation methods that can be used for this. Students will be able to carry out chemical calculations for selected treatment processes and apply generally accepted technical rules and standards to these processes.			
Personal				
Competence Social Competence	Working in a diverse group of specialists, students will be able to develop and document complex solutions for the management and treatment of drinking water. They will be able to take an appropriate professional position, for example representing user interests. They will			
Autonomy	Students will be in a position to work on a	subject independently and	present on	this subject.
Workload in Hours	Independent Study Time 96, Study Time in	Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	60 min (chemistry) + presentation			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Civil Engineering: Specialisation Geotechic Civil Engineering: Specialisation Coastal Engineering: Specialisation Water and Energy and Environmental Engineering Engineering: Elective Compulsory International Management and Engineering: Engineering: Elective Compulsory Water and Environmental Engineering: Sp	nical Engineering: Elective Engineering: Elective Compd Traffic: Compulsory ng: Specialisation Energing: Specialisation II. Energing: Specialisation II.	Compulso pulsory gy and ergy and	Environmenta
	[01]			



Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0311: Chemistry of Drinking Water Treatment		
Тур	Lecture	
Hrs/wk	2	
СР	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dr. Klaus Johannsen	
Language	DE	
Cycle	WiSe	
	The topic of this course is water chemistry with respect to drinking water treatment and water distribution	
	Major topics are solubility of gases, carbonic acid system and calcium carbonate, blending, softening, redox processes, materials and legal requirements on drinking water treatment. Focus is put on generally accepted rules of technology (DVGW- and DIN-standards).	
Content	Special emphasis is put on calculations using realistic analysis data (e.g. calculation of pH or calcium carbonate dissolution potential) in exercises. Students can get a feedback and gain extra points for exam by solving problems for homework.	
	Knowledge of drinking water treatment processes is vital for this lecture. Therefore the most important processes are explained coordinated with the course "Water resources management" in the beginning of the semester.	
	MHW (rev. by Crittenden, J. et al.): Water treatment principles and design. John Wiley & Sons, Hoboken, 2005. Stumm, W., Morgan, J.J.: Aquatic chemistry. John Wiley & Sons, New York, 1996.	
Literature	DVGW (Hrsg.): Wasseraufbereitung - Grundlagen und Verfahren. Oldenbourg Industrie Verlag, München, 2004.	
	Jensen, J. N. : A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.	

Course L0312: Chemistry of Drinking Water Treatment	
Тур	Recitation Section (large)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. Klaus Johannsen
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L0402: Water Resource Management		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Mathias Ernst	
Language	DE	
Cycle	WiSe	
Content	The lecture provides comprehensive knowledge on interaction of water ressource management and drinking water supply. Content overview: • Current situation of global water resources - User and Stakeholder conflicts - Wasserressourcenmanagement in urbane Gebieten - Rechtliche Aspekte, Organisationsformen Trinkwasserversorgungsunternehmen. - Ökobilanzierung, Benchmarking in der Wasserversorgung	
Literature	 Aktuelle UN World Water Development Reports Branchenbild der deutschen Wasserwirtschaft, VKU (2011) Aktuelle Artikel wissenschaftlicher Zeitschriften Ppt der Vorlesung 	

Course L0403: Water Resource Management	
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Mathias Ernst
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses			
Title Integrated Transportation	Typ Hrs/n Project-/problem-based Learning (L1068)	wk CP 6	
Module Responsible	Prof. Carsten Gertz		
Admission Requirements	INONE		
Recommended Previous Knowledge	Dianning and Traffic Engineerin	some knowledge of transport planning, e.g. through taking the undergraduate class "Transport Planning and Traffic Engineerin	
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	 describe interdependencies between land-use/location transportation/mobility behaviour explain and evaluate the social, ecological and economic effects of use policy measures. relate current issues in the area of integrated transport planning opinion on them. 		
Skills	Students are able to: • quantify important parameters, which influence travel demand or are • comprehensively examine a pre-defined or self-selected topic fro studies perspective and document the results in accordan conventions.	m a transportati	
Personal Competence			
Social Competence	 provide feedback on topical contents and their teaching. constructively handle feedback on their own work. produce results in group work and document these. 		
Autonomy	Students are able to: assess potential consequences of their future professional activities independently plan working on a pre-defined project topic, acquired knowledge and use appropriate means for its execution.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		



Examination	Written elaboration	
Examination duration and scale	written assignment with presentation during the semester	
Assignment for the	H odistics intrastructure and Mobility. Specialisation intrastructure and Mobility. Electivel	

Course L1068: Integrated Transportation Planning	
Тур	Project-/problem-based Learning
Hrs/wk	4
СР	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß
Language	DE
Cycle	WiSe
Content	The course will provide students with an understanding of interdependencies between landuse and transportation. Specific topics include a.o.: • interactions between transport and the environment and consequent limitations • characteristics of integrated planning • complex planning processes • interdependencies of location choice and mobility behaviour • transport and land-use policies • project on current issues in transportation studies
Literature	Kutter, Eckhard (2005) Entwicklung innovativer Verkehrsstrategien für die mobile Gesellschaft. Erich Schmidt Verlag. Berlin. Bracher, Tilman u. a. (Hrsg.) (68. Ergänzung 2013) Handbuch der kommunalen Verkehrsplanung. Herbert Wichmann Verlag. Berlin, Offenbach. (Loseblattsammlung mit kontinuierlichen Ergänzungen)



Module M0963: S	Steel and Composite Structures			
Courses				
Title Steel and Composite Structure Steel and Composite Structure Steel Bridges (L1097)		Typ Lecture Recitation Section (large) Lecture	2 2	CP 2 2 2
Module Responsible	Prof. Marcus Rutner			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of steel construction (i.e. Steel Struc	ctures I and II, BUBC)		
Educational Objectives	After taking part successfully, students hav	e reached the following lea	rning results	
Professional Competence				
Knowledge	After successful completition, students can • describe the phenomenon of local buckling • explain warping torsion • illustrate the behaviour of composite structures • specify the principles in design of composite structures • sketch the contructions of steel and composite bridges			
Skills	After successful participation students are at the check stiffened and unstiffened plate is recognize and verify warping tosion design composite structures design bridges and o perform the design bridges.	ted structures n in strucures		
Personal Competence				
Social Competence				
Autonomy	! !			
Workload in Hours	Independent Study Time 96, Study Time in	Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	I 18() min			
_	Civil Engineering: Specialisation Structura Civil Engineering: Specialisation Geotechr Civil Engineering: Specialisation Coastal E Civil Engineering: Specialisation Water an International Management and Engineer Compulsory	nical Engineering: Elective Engineering: Elective Comp d Traffic: Elective Compulso	Compulsory oulsory ory	ng: Elective



Course L1204: Steel and Composite Structures		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Marcus Rutner	
Language	DE	
Cycle	WiSe	
Content	 Local-buckling of plated structures Warping torsion Composite-girders, -columns, -slabs, -bridges Principles in composite constructions Bridge-design and -construction 	
Literature	Petersen, C.: Stahlbau, 4.Auflage 2013, Springer-Vieweg Verlag Minnert, J. Wagenknecht, G.: Verbundbau-Praxis - Berechnung und Konstruktion nach Eurocode 4, 2.Auflage 2013, Bauwerk Beuth Verlag	

Course L1205: Steel and Composite Structures	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Тур	Lecture
Hrs/wk	
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Jörg Ahlgrimm
Language	
Cycle	
	Lecture Contents ,Steel Bridge Construction' DrIng. Jörg Ahlgrimm
	- From tendering and contracting to completion - the development of a steel bridge
	- Contents of a bridge static - structural details, examples of analysis in detail:
	-> effective width in regard to the longitudinal stiffeners
	-> Bearing point, bearing stiffener
	-> Crossbeam breakthrough, crossbeam reinforcement
	-> Analysis of the Rib-to-Floorbeam (RF) connection (web-tooth of the floorbeam between trapezoidal shaped Ribs)
Content	- Steel grades, -designation, testing methods and approval certificates
	- Nondestructive weld inspecting
	- Corrosion protection
	- Bridge bearing - types, format, function, dimensioning, installation
	- Expansion Joints
	- Oscillation of bridge hangers and cables - oscillation damper
	- Opening bridges- Detailed reviews to different assembling procedures and - implements
	- Selective damage events
	Requirements: Basic knowledge in the calculation, dimensioning, and construction structural elements and joints of constructional steelwork
	 Herbert Schmidt, Ulrich Schulte, Rainer Zwätz, Lothar Bär: Ausführung von Stahlbauten
Literature	Petersen, Christian: Stahlbau, Abschnitt Brückenbau
	 Ahlgrimm, J., Lohrer, I.: Erneuerung der Eisenbahnüberführung in Fulda-Horas üldie Fulda, Stahlbau 74 (2005), Heft 2, S. 114



Module M0969: S	elected Topics in Civil Engineering		
Courses			
Title	Тур	Hrs/wk	СР
Analysis of Offshore Struc	ctures (L1867) Lecture	1	1
Design of Concrete Struct	utures (L1840) Lecture	2	2
Design of Prefabricated C	oncrete Structures (L0596) Lecture	1	1
Design of Prefabricated C	oncrete Structures (L0597) Recitation Section (large	e) 1	1
Forum I - Geotechnics and	d Construction Management (L1634) Seminar	1	1
Forum II - Geotechnics ar	nd Construction Management (L1635) Seminar	1	1
Timber Structures (L1151)) Seminar	2	2
Glass Structures (L1152)	Lecture	2	2
Glass Structures (L1447)	Recitation Section (larg	e) 1	1
Wind turbine design (L190	5) Lecture	1	1
Module Responsible	Prof. Uwe Starossek		
Admission Requirements	None		
Recommended Previous Knowledge	none		
Educational Objectives	After taking part successfully, students have reached the following I	earning resu	llts
Professional Competence			
Knowledge	 Students are able to find their way through selected special areas within civil and structural engineering. Students are able to explain basic models and procedures in selected special areas of civil and structural engineering. Students are able to interrelate scientific and technical knowledge. 		
Skills	 Students are able to apply basic methods in selected an engineering. 	eas of civil	and structural
Personal			
Competence			
Social Competence			
Autonomy	 Students can chose independently, in which fields the knowledge and skills through the election of courses. 	ey want to	deepen their
Workload in Hours	Depends on choice of courses		
Credit points	6		
_	Civil Engineering: Specialisation Structural Engineering: Elective C Civil Engineering: Specialisation Geotechnical Engineering: Elective Civil Engineering: Specialisation Coastal Engineering: Elective Col Civil Engineering: Specialisation Water and Traffic: Elective Compu	e Compulso npulsory	ry



Course L1867: Analysi	is of Offshore Structures
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	
Examination duration and scale	30 min
Lecturer	Dr. Said Fawad Mohammadi
Language	DE/EN
Cycle	SoSe
Content	Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques
Literature	
Literature	

Course L1840: Design of Concrete Strucutures		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form		
Examination duration and scale	20 min	
Lecturer	Dr. Karl Morgen	
Language	DE	
Cycle	WiSe	
Content		
Literature	Schlaich/Schäfer, Konstruieren im Stahlbau, BetonKalender 2001, TII, Verlag Ernst & Sohn	



Course L0596: Design	of Prefabricated Concrete Structures
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 application and advantages and disadvantages of precast concrete structures basics of design - precast element production - construction - tolerances elements of a warehouse design of a beam - joints design of D-regions: half joints, corbels, openings slab types - walls - facades footings: pocket and block foundations joints - connections shear design of the interface between concrete cast at different times unreinforced concrete structures
Literature	 Bachmann H., Steinle A.; Hahn V.: Bauen mit Betonfertigteilen. Betonkalender 2009, Teil I, Verlag Ernst & Sohn, Berlin Bindseil P.: Stahlbetonfertigteile. Werner Verlag, 1998 FIP: FIP Handbuch für Planung und Entwerfen von Fertigteilbauten (siehe Zeitschrift: Beton- und Fertigteiltechnik ab 3/1996) Bergmeister K.: Konstruieren von Fertigteilen. Betonkalender 2005 Teil 2, S. 163-240 Reineck KH.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 Teil 2, S. 241-296 Graubner CA. et. al.: Bemessung von Fertigteilen nach DIN 1045-1. Betonkalender 2005 Teil 2, S. 297-374 Broschüren der Fachvereinigung Deutscher Betonfertigteilbau e.V. siehe: www.fdb-fertigteilbau.de www.systembauweise.de

Course L0597: Design of Prefabricated Concrete Structures		
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 scale	Siehe korrespondierende Vorlesung	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1634: Forum	I - Geotechnics and Construction Management
Тур	Seminar
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
	Mündliche Prüfung
Examination duration and scale	30 min
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	Lectures about projects and issues with practical and scientific relevance.
Literature	

Course L1635: Forum II - Geotechnics and Construction Management		
Тур	Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Examination Form		
Examination duration and scale	30 min	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	SoSe	
Content	Lectures about projects and issues with practical and scientific relevance.	
Literature		

Course L1151: Timber Structures	
Тур	Seminar
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	
Examination duration and scale	90 min
Lecturer	Prof. Torsten Faber
Language	DE
Cycle	WiSe
Content	
Literature	



Typ Lecture Hrs/wk 2 CP 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Examination Form Klausur Examination duration and scale 60 min Lecturer Marvin Matzik Language DE
Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Examination Form Klausur Examination duration and scale Lecturer Marvin Matzik Language DE
Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Examination Form Klausur Examination duration and scale Lecturer Marvin Matzik Language DE
Examination Form Klausur Examination duration and scale Lecturer Marvin Matzik Language DE
Examination duration and scale Lecturer Marvin Matzik Language DE
and scale Lecturer Marvin Matzik Language DE
Language DE
Cycle WiSe
Glass structures - Introduction of the material glass (production, refinement, material characteristic) - design of facades - facade types - static calculation of glazing - static calculation of facades - load bearing behavior of glazing (plate or membrane stiffness) - vertical / horizontal glazing with safety-related requirements - glass structures - fire safety of glass facades - construction physics of facades and glazing
Literature

Course L1447: Glass Structures	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	
Examination duration and scale	60 min
Lecturer	Marvin Matzik
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L1905: Wind turbine design	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	
Examination duration and scale	30 min
Lecturer	Dr. Jörn Scheller
Language	DE
Cycle	SoSe
Content	
Literature	



Module M0967: S	Study Work Harbour and Coastal Engineering	
Courses		
Title	Typ Hrs/wk CP	
Module Responsible	Prof. Peter Fröhle	
Admission Requirements	INONE	
Recommended Previous Knowledge	Subjects of the Port and Coastal Engineering specialisation.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
	The students are able to demonstrate their detailed knowledge in the field of port and coasta engineering. They can exemplify the state of technology and application and discuss critically in the context of actual problems and general conditions of science and society.	
	The students can develop solving strategies and approaches for fundamental and practical problems in port and coastal engineering. They may apply theory based procedures and integrate safety-related, ecological, ethical, and economic view points of science and society.	
Skills	Scientific work techniques that are used can be described and critically reviewed. The students are able to independently select methods for the project work and to justify this choice. They can explain how these methods relate to the field of work and how the context of application has to be adjusted. General findings and further developments may essentially be outlined.	
Personal		
Competence Social Competence	The students are able to condense the relevance and the structure of the project work, the	
Autonomy	The students are capable of independently planning and documenting the work steps and procedures while considering the given deadlines. This includes the ability to accurately procure the newest scientific information. Furthermore, they can obtain feedback from expert with regard to the progress of the work, and to accomplish results on the state of the art is science and technology.	
Workload in Hours	Independent Study Time 180, Study Time in Lecture 0	
Credit points	6	
Studienleistung		
Examination		
Examination duration and scale	Line number of bades depends on the task.	
Assignment for the Following Curricula	ICIVII Engineering. Specialisation Coastal Engineering. Compilisory	



Module M0997: S	Structural Analysis - Selec	ted Topics		
Courses				
Title		Тур	Hrs/wk	СР
Plates and Shells (L1199)		Lecture	2	2
Nonlinear Analysis of Fran	me Structure (L1200)	Lecture	2	2
Nonlinear Analysis of Frai	me Structure (L1201)	Recitation Section	(large) 2	2
Module Responsible	Prof. Uwe Starossek			
Admission Requirements	None			
Recommended Previous Knowledge	Mechanics I/II, Mathematics I/II, Diff	erential Equations I		
Educational Objectives	After taking part successfully, stude	ents have reached the followi	ng learning resu	Its
Professional				
Competence				
Knowledge	After successful completion of this structural analysis.	module, students can expla	in selected elem	ents of highe
Skills	After successful completion of this the applicability of the presented use these methods for performing	methods of advanced structo		
Personal Competence	,			
Competence	Students can			
Social Competence	defend their own work resupromote the scientific devel			1
Autonomy	The students have the opportunity	to voluntarily and independe	ntly work homew	ork problems
Workload in Hours	Independent Study Time 96, Study	Time in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	135 min			
Assignment for the Following Curricula	Civil Engineering: Specialisation S Civil Engineering: Specialisation C Civil Engineering: Specialisation C	eotechnical Engineering: Ele	ective Compulso	ry



Tvp	Lecture	
Hrs/wk		
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Jürgen Priebe	
Language	DE	
Cycle	WiSe	
Content	Theory of plates loaded in-plane Governing equations (equilibrium, kinematics, constitutive law) Differential equation Airy stress function Plane stress / plane strain Structural behaviour of plates loaded in-plane Theory of plates in bending Governing equations (equilibrium, kinematics, constitutive law) Differential equation Navier solution / Fourier series expansion Approximation procedures Structural behaviour of plates in bending Shell theory Phenomenona of the structural behaviour of shells Membrane and bending theory Equilibrium equations of shells of revolution Stress resultants and deformations of the spherical shell, the half spherical shell, a the cylindrical shell Stability problems (overview) Plate buckling Shell buckling	
Literature	 Basar, Y.: Krätzig, W.B. (1985): Mechanik der Flächentragwerke. Vieweg-Verlag Braunschweig, Wiesbaden Girkmann, K. (1963): Flächentragwerke, Springer Verlag, Wien, 1963, unverändert Nachdruck 1986 Zienkiewicz, O.C. (1977): The Finite Element Method in Enginieering Science McGraw-Hill, London 	



Course L1200: Nonlinear Analysis of Frame Structure		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	WiSe	
Content	-Types of nonlinearity -relevance of nonlinear effects on structural analysis -comparison and classification of 1 st order theory, 2 nd order theory and 3 rd order theory with regard to the coverage of geometric nonlinearity -fundamentals of 2 nd order elasticity theory for frame structures -application of 2 nd order elasticity theory using finite elements: common displacement method -fundamentals of analytical application of 2 nd order elasticity theory: derivation and solution of differential equation -structurally applied methods of analytical application of 2 nd order elasticity theory: common displacement method using analytical stiffness matrix, slope-deflection method for sway and non-sway frame structures, consideration of imperfections 1 st order plastic hinge theory Rothert, H.; Gensichen, V. (1987): Nichtlineare Stabstatik. Springer Verlag, Berlin	
Literature	нотпет, н.; Gensichen, v. (1987): Nichtlineare Stabstatik. Springer Verlag, Berlin	

Course L1201: Nonlinear Analysis of Frame Structure	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Specialization Geotechnical Engineering

Module M0699: A	dvanced	Foundat	tion Engineerin	g and Soil Labora	atory Co	ourse
Courses						
Title Soil Laboratory Course (L0499) Advanced Foundation Engineering (L0497) Advanced Foundation Engineering (L0498)			Typ Practical Course Lecture Recitation Section (large)	Hrs/wk 1 2 1	CP 2 2 2	
Module Responsible	Prof. Jürgen	Grabe				
Admission Requirements	None					
Recommended Previous Knowledge						
Educational Objectives	After taking p	art success	fully, students have re	eached the following lea	ırning resu	lts
Professional Competence Knowledge Skills Personal Competence Social Competence Autonomy						
Workload in Hours	Independent	Study Time	124, Study Time in L	ecture 56		
Credit points						
Studienleistung	Yes Yes	Bonus None	Form Subject theore practical work	Descriptio	on	
Examination	Written exam					
Examination duration and scale	60 min					
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory					



Course L0499: Soil Laboratory Course				
Тур	Practical Course			
Hrs/wk	1			
СР	2			
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14			
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 L0497: Advance	Course L0497: Advanced Foundation Engineering				
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	WiSe				
Content	 Vertical drains Piles Ground improvement (Deep Compaction, Soil mixing) Vibration driving Jet grouting Slurry wall Deep excavation 				
Literature	 EAK (2002): Empfehlungen für Küstenschutzbauwerke EAU (2004): Empfehlungen des Arbeitsausschusses Uferbauwerke EAB (1988): Empfehlungen des Arbeitskreises Baugruben Grundbau-Taschenbuch, Teil 1-3, (1997), Ernst & Sohn Verlag 				



Course L0498: Advanced Foundation Engineering			
Тур	Recitation Section (large)		
Hrs/wk	1		
СР	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Jürgen Grabe		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0858: C	Coastal Hydraulic Engineeri	ng I		
Courses				
Title Basics of Coastal Enginee	ering (L0807)	Typ Lecture	Hrs/wk	CP 4
Basics of Coastal Enginee	ering (L1413)	Project-/problem-based Learning	1	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of hydraulic engineering, hydro	ology and hydromechanics		
Educational Objectives	After taking part successfully, students	s have reached the following lea	arning resu	Its
Professional Competence				
Knowledge	The students are able to define and explain the basic concepts of coastal engineering and port engineering. They are able to apply the concepts to selected practical problems of coastal engineering. Students can define and determine the basics for design and dimensioning of coastal engineering constructions.			
Skills	The students are capable to apply basic design approaches to selected and pre-defined design tasks in coastal engineering.			d pre-defined
Personal				
Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as the design of coastal protection structures. Additionaly, they will be able to work in team with engineers of other disciplines, for instance designing of coastal breakwaters.			
Autonomy	The students will be able to indep problems.	endently extend their knowled	dge and a	pplyit to new
Workload in Hours	Independent Study Time 124, Study T	ime in Lecture 56		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 2 h			respect to the
Assignment for the Following Curricula	general understanding of the lecture of Civil Engineering: Specialisation Structivil Engineering: Specialisation Geo Civil Engineering: Specialisation Coal International Management and Eng Compulsory	ctural Engineering: Elective Cor technical Engineering: Compuls stal Engineering: Compulsory	mpulsory sory	ering: Elective



Course L0807: Basics of Coastal Engineering				
Тур	Lecture			
Hrs/wk	3			
СР	4			
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42			
Lecturer	Prof. Peter Fröhle			
Language	DE			
Cycle	WiSe			
Content	 Design-approaches Filter Rubble mound constructions Piles Vertical constructions 			
Literature	Coastal Engineering Manual, CEM Vorlesungsumdruck			

Course L1413: Basics	Course L1413: Basics of Coastal Engineering			
Тур	Project-/problem-based Learning			
Hrs/wk	1			
СР	2			
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14			
Lecturer	Prof. Peter Fröhle			
Language	DE			
Cycle	WiSe			
Content	See interlocking course			
Literature	See interlocking course			



Module M0964: S	Structures in Foundation and	Hydraulic Engineerin	g	
Courses				
Title		Тур	Hrs/wk	СР
	ation and Hydraulic Engineering (L1146)	Lecture	2	3
Underground Constructio Underground Constructio	,	Lecture	1	2 1
	,	Recitation Section (large)	1	ı
Module Responsible	la contraction of the contractio			
Admission Requirements	None			
	Modules from Bachelor studies Civil and	l environmental engineering:		
Recommended	Geotechnics I-II			
Previous Knowledge	Steel Structures I-II			
Educational Objectives	After taking part successfully, students h	ave reached the following lea	rning resu	Its
Professional				
Competence				
Knowledge	Knowledge of different tunnel construction types as well as special methods and techniques of subsoil construction. The students get deeper knowledge of steel and ground engineering a well as constructions knowledge concerning quay walls. Futhermore, the students get all the neccessary knowledge to design singular construction elements for sheet pile walls and the know how to choose the right construction elements depending on the influencing conditions.			
Skills	Basic knowledge of tunnel design as well as practical skills in structural tunnel analysis Furthermore, the students are able to dimension sheet pile wall construction regarding all constrution elements, to choose the suitable construction elements with respect to the influencing conditions, to design all kinds of sheet pile walls (wave sheet pile walls and combined sheet pile walls) and to dimension all construction elements and connections.			
Personal				
Competence] 			
•	Capacity for teamwork concerning proje	•		
	Promotion of independent and creative v		a design e	xercise.
	Independent Study Time 124, Study Tim	e in Lecture 56		
Credit points				
Studienleistung				
	Written exam			
Examination duration and scale	120 minutes			
_	Civil Engineering: Specialisation Structure Civil Engineering: Specialisation Geotect Civil Engineering: Specialisation Coasta Civil Engineering: Specialisation Water International Management and Engine Compulsory	chnical Engineering: Compuls al Engineering: Compulsory and Traffic: Elective Compuls	ory	ering: Electiv
	1			



Course L1146: Steel Structures in Foundation and Hydraulic Engineering				
Тур	Lecture			
Hrs/wk	2			
СР	3			
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28			
Lecturer	Frank Feindt			
Language	DE			
Cycle	WiSe			
Content	Design of a sheet pile wall, design of a combined sheet pile wall, piles, walings, connections, fatigue			
Literature	EAU 2012, EA-Pfähle, EAB			

Course L0707: Underg	ground Constructions
Тур	Lecture
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Marius Milatz
Language	DE
Cycle	WiSe
Content	 Definitions Historical development in tunneling Geology for tunneling Hard rock tunneling (construction composite and machines) Tunnelung in temporarly stable soil with conventional construction methods Tunneling in soft soils (form of supports, shield types, compressed air application) Pipe jacking Tunnel Lining, tunnel supporting structures Calculation approaches for supporting structures in shield-driven tunnels Surveying for tunneling Safety requirements Construction Contract Literature and sources
Literature	 Vorlesung/Übung s. www.tu-harburg.de/gbt

Course L1811: Underground Constructions			
Тур	Recitation Section (large)		
Hrs/wk	1		
СР	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Marius Milatz		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0511: E	Electricity Generation from W	ind and Hydro Pow	er	
Courses				
Title Renewable Energy Project Hydro Power Use (L0013 Wind Turbine Plants (L00		Typ Project Seminar Lecture Lecture	Hrs/wk 1 1 2	CP 1 1 3
Wind Energy Use - Focus	•	Lecture	1	1
Module Responsible	Dr. Joachim Gerth			
Admission Requirements	INOne			
Recommended Previous Knowledge	Module: Technical Thermodynamics I, Module: Technical Thermodynamics II, Module: Fundamentals of Fluid Mechai			
Educational Objectives	After taking part successfully, students	have reached the following	learning resu	lts
Professional Competence				
Knowledge	By ending this module students can explain in detail knowledge of wind turbines with a particular focus of wind energy use in offshore conditions and can critical comment these aspects in consideration of current developments. Furthermore, they are able to describe fundamentally the use of water power to generate electricity. The students reproduce and explain the basic procedure in the implementation of renewable energy projects in countries outside Europe. Through active discussions of various topics within the seminar of the module, student improve their understanding and the application of the theoretical background and are thus			
Skills	able to transfer what they have learned in practice. Students are able to apply the acquired theoretical foundations on exemplary water or win power systems and evaluate and assess technically the resulting relationships in the conte of dimensioning and operation of these energy systems. They can in compare critically the special procedure for the implementation of renewable energy projects in countries outside Europe with the in principle applied approach in Europe and can apply this procedure of exemplary theoretical projects.			
Personal Competence				
Social Competence	Students can discuss scientific tasks st	ubjet-specificly and multidis	sciplinary withi	n a seminar.
Autonomy	Students can independently exploit sources in the context of the emphasis of the lecture material to clear the contents of the lecture and to acquire the particular knowledge about the subject area.			
Workload in Hours	Independent Study Time 110, Study Tir	me in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	L3 nours wriπen exam			
	Civil Engineering: Specialisation Struct Civil Engineering: Specialisation Geote			ry



Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Energy Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Renewable Energy: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Product Development, Materials and Production: Specialisation Product Development: Assignment for the Elective Compulsory **Following Curricula** Product Development, Materials and Production: Specialisation Production: Elective Compulsory Product Development, Materials and Production: Specialisation Materials: Elective Compulsory Renewable Energies: Core qualification: Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory Theoretical Mechanical Engineering: Specialisation Energy Systems: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory

Water and Environmental Engineering: Specialisation Environment: Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory



Course L0014: Renewable Energy Projects in Emerged Markets		
Тур	Project Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Andreas Wiese	
Language	DE	
Cycle	SoSe	
Literature	1. Introduction □ Development of renewable energies worldwide □ History □ Future markets ○ Special challenges in new markets - Overview 2. Sample project wind farm Korea ○ Survey ○ Technical Description ○ Project phases and characteristics 3. Funding and financing instruments for EE projects in new markets ○ Overview funding opportunitie ○ Overview countries with feed-in laws ○ Major funding programs 4. CDM projects - why, how , examples ○ Overview CDM process ○ Examples ○ Examples ○ Exercise CDM 5. Rural electrification and hybrid systems - an important future market for EE ○ Rural Electrification - Introduction ○ Types of Elektrizifierungsprojekten ○ The role of the EEInterpretation of hybrid systems ○ Project example: hybrid system Galapagos Islands 6. Tendering process for EE projects - examples ○ South Africa ○ Brazil 7. Selected projects from the perspective of a development bank - Wesley Urena Vargas, KfW Development Bank ○ Geothermal ○ Wind or CSP Within the seminar, the various topics are actively discussed and applied to various cases of application.	



Course L0013: Hydro Power Use		
Typ Lecture		
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Stephan Heimerl	
Language	DE	
Cycle	SoSe	
Content	 Introduction, importance of water power in the national and global context Physical basics: Bernoulli's equation, usable height of fall, hydrological measures, loss mechanisms, efficiencies Classification of Hydropower: Flow and Storage hydropower, low and high pressure systems Construction of hydroelectric power plants: description of the individual components and their technical system interaction Structural engineering components; representation of dams, weirs, dams, power houses, computer systems, etc. Energy Technical Components: Illustration of the different types of hydraulic machinery, generators and grid connection Hydropower and the Environment Examples from practice 	
Literature	 Schröder, W.; Euler, G.; Schneider, K.: Grundlagen des Wasserbaus; Werner, Düsseldorf, 1999, 4. Auflage Quaschning, V.: Regenerative Energiesysteme: Technologie - Berechnung - Simulation; Carl Hanser, München, 2011, 7. Auflage Giesecke, J.; Heimerl, S.; Mosony, E.: Wasserkraftanlagen Planung, Bau und Betrieb; Springer, Berlin, Heidelberg, 2009, 5. Auflage von König, F.; Jehle, C.: Bau von Wasserkraftanlagen - Praxisbezogene Planungsunterlagen; C. F. Müller, Heidelberg, 2005, 4. Auflage Strobl, T.; Zunic, F.: Wasserbau: Aktuelle Grundlagen - Neue Entwicklungen; Springer, Berlin, Heidelberg, 2006 	



Course L0011: Wind Turbine Plants		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Rudolf Zellermann	
Language	DE	
Cycle	SoSe	
Content	 Historical development Wind: origins, geographic and temporal distribution, locations Power coefficient, rotor thrust Aerodynamics of the rotor Operating performance Power limitation, partial load, pitch and stall control Plant selection, yield prediction, economy Excursion 	
Literature	Gasch, R., Windkraftanlagen, 4. Auflage, Teubner-Verlag, 2005	



Course L0012: Wind Energy Use - Focus Offshore		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Skiba	
Language	DE	
Cycle	SoSe	
Content	 Introduction, importance of offshore wind power generation, Specific requirements for offshore engineering Physical fundamentals for utilization of wind energy Design and operation of offshore wind turbines, presentation of different concepts of offshore wind turbines, representation of the individual system components and their system-technical relationships Foundation engineering, offshore site investigation, presentation of different concepts of offshore foundation structures, planning and fabrication of foundation structures Electrical infrastructure of an offshore wind farm, Inner Park cabling, offshore substation, grid connection Installation of offshore wind farms, installation techniques and auxiliary devices, construction logistics Development and planning of offshore wind farms Operation and optimization of offshore wind farms Day excursion 	
Literature	 Gasch, R.; Twele, J.: Windkraftanlagen - Grundlagen, Entwurf, Planung und Betrieb; Vieweg + Teubner, Stuttgart, 2007, 7. Auflage Molly, J. P.: Windenergie - Theorie, Anwendung, Messung; C. F. Müller, Heidel-berg, 1997, 3. Auflage Hau, E.: Windkraftanalagen; Springer, Berlin, Heidelberg, 2008, 4.Auflage Heier, S.: Windkraftanlagen - Systemauslegung, Integration und Regelung; Vieweg + Teubner, Stuttgart, 2009, 5. Auflage Jarass, L.; Obermair, G.M.; Voigt, W.: Windenergie: Zuverlässige Integration in die Energieversorgung; Springer, Berlin, Heidelberg, 2009, 2. Auflage 	



Module M1351: C	construction Process	ses		
Courses				
Title		Тур	Hrs/wk	СР
Digital Building (L1908)		Lecture	2	2
Lean Construction (L1910		Lecture	2	2
System Dynamics (L1909)	Lecture	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge				
Educational Objectives	After taking part successfull	y, students have reached the follo	wing learning resu	lts
Professional				
Competence				
Knowledge				
Skills				
Personal				
Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96	6, Study Time in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	60 min			
_	Civil Engineering: Specialis Civil Engineering: Specialis	sation Coastal Engineering: Electives ation Geotechnical Engineering: Esation Structural Engineering: Elective Coation Water and Traffic: Elective Coation	Elective Compulsor tive Compulsory	ry

Course L1908: Digital Building	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Katja Maaser
Language	DE
Cycle	SoSe
Content	
Literature	



Course L1910: Lean Construction	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Theo Herzog
Language	DE
Cycle	SoSe
Content	
Literature	

Course L1909: System Dynamics	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Nicole Mörchen, Dr. Markus Salge
Language	DE
Cycle	SoSe
Content	
Literature	



Module M0593: E	Building Materials an	nd Building	Preserv	ation		
Courses						
Title Anchor Technology and E Repair of Structures (L02: Mineral Building Materials		onnections (L0257	Typ Recitati Lecture Lecture		Hrs/wk 1 1 2	CP 1 1 2
Technology of mineral Bu	ilding Materials (L0256)		Project- Learnin	/problem-based	1	1
Transport Processes in B	uilding Materials and Damage I	Processes (L025		_	1	1
	Prof. Frank Schmidt-Döhl					
Admission Requirements	None					
Recommended Previous Knowledge	Basic knowledge about I example by the modules I Materials and Building Che	Principles of Bu				
Educational Objectives	After taking part successful	lly, students hav	e reached	the following lea	rning resu	ılts
Professional Competence						
•	The students are able to describe the components of mineral building materials and their function in detail and to use them for the manufacture of special mineral building materials. They are able to show the characteristics of mineral building materials. They are able to describe the manufacture, properties and fields of application of special mortars and special concretes and the correlations of their material parameters. They are able to show the principles of anchor technology and design.					
Skills	The students are able to perform an optimization of granulometry of a mineral building material. They are able to design a special mineral mortar and to manufacture this mortar. The students are able to manufacture post installed rebar connections. They are able to recognize damages, to assess possible causes, to use the fundamentals of construction preservation and to select repair and strengthening measures.					
Personal Competence Social Competence	The students are able to detheir results to the lecture adjust their results. The students of this feedback.	r and the other	students.	In a critical disc	ussion the	ey defend and
Autonomy	The students are able to their project and to investig				s and lab	equipment fo
Workload in Hours	Independent Study Time 9	6, Study Time ir	Lecture 84			
Credit points						
Studienleistung	Compulsory Bonus Yes 20 %	•	oretical	Descriptio and	n	
Fyamination	Written exam	practical work				
Examination duration						
and scale						



Assignment for the Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Following Curricula Civil Engineering: Specialisation Structural Engineering: Elective Compulsory

Civil Engineering: Specialisation Water and Traffic: Elective Compulsory

Course L0257: Anchor	Technology and Design, Post Installed Rebar Connections
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	 Working principles of friction, keying and bonding anchors Selection of anchors Anchor design Installation of anchors Post installed rebar connections and additional german regulations
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung Beton-Kalender 2012: Infrastrukturbau, Befestigungstechnik. Eurocode 2. Herausgegeben von Konrad Bergmeister, Frank Fingerloos und Johann-Dietrich Wörner; 2012 Ernst & Sohn GmbH & Co. KG. Published by Ernst & Sohn GmbH & Co. KG. DIBt: Hinweise für die Montage von Dübelverankerungen; Oktober 2010 Ratgeber Dübeltechnik, Basiswissen - Metalldübel, chemische Dübel, Kunststoffdübel; Herausgeber Hilti AG

Course L0255: Repair of Structures		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	SoSe	
Content	Maintenance of structures, repair and strengthening, subsequent waterproofing of structures	
Literature	BetonMarketing Deutschland (Hrsg.): Stahlbetonoberflächen - schützen, erhalten, instandsetzen	



Course L0253: Mineral 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	SoSe	
	Components of mineral building materials and their function, binding materials, concrete and mortar, special mortars, special concretes	
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis	

Course L0256: Technology of mineral Building Materials		
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	SoSe	
Content	Design and production of a special mineral building material	
	Taylor, H.F.W.: Cement Chemistry	
Literature	Springenschmid, R.: Betontechnologie für die Praxis	

Course L0254: Transport Processes in Building Materials and Damage Processes	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl, Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	Transport Processes in Building Materials and Damage Processes
Literature	Blaich, J.: Bauschäden, Analyse und Vermeidung



Module M0723: D	esign of Prestressed Structures a	and Concrete Bri	dges	
Courses				
=	ructures and Concreet Bridges (L0603) ructures and Concreet Bridges (L0604)	Typ Lecture Recitation Section (large)	Hrs/wk 3 2	CP 4 2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
Recommended Previous Knowledge	Detailed knowledge on the design of concrete structures.			
Educational Objectives	After taking part successfully, students have re	ached the following lea	rning results	6
Professional Competence				
Knowledge	The students know the main bridge types, the explain the basic design methods. They can explain the basic design methods.			
Skills	The students are able to design reinforced or p	The students are able to design reinforced or prestressed concrete bridges.		
Personal Competence				
Social Competence	The students can design in teamwork a real concrete bridge.			
Autonomy	The students are able to design a prestressed concrete bridge and discuss the problems and results with other students.			
Workload in Hours	Independent Study Time 110, Study Time in Le	ecture 70		
Credit points				
Studienleistung				-
	Written exam			
Examination duration and scale	180 minutes			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory			



Typ Lecture Hrs/wk 3 CP 4 Workload in Hours Independent Study Time 78, Study Time in Lecture 42 Lecturer Prof. Günter Rombach Language DE Cycle SoSe prestressed structures	ourse L0603: Design	of Prestressed Structures and Concreet Bridges
Workload in Hours Independent Study Time 78, Study Time in Lecture 42	Тур	Lecture
Morkload in Hours Independent Study Time 78, Study Time in Lecture 42	Hrs/wk	3
Lecturer Language Cycle SoSe prestressed structures	СР	4
Language Cycle SoSe prestressed structures basis of prestressed structures differences between reinforced and prestressed concrete structures history of prestressing construction materials: concrete, tendons, ducts, anchorage systems construction: prestressing methods prestressing forces and member forces (friction, elongation) tendon layout time dependant prestressing losses design of prestressed structures design of anchorage region non-bonded prestressing Content Concrete bridges history of bridges design of bridges loads on bridges member forces for slab, T-beam, hollow box, frame and arch bridges precast bridges - precast segmental bridges	Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
restressed structures basis of prestressed structures differences between reinforced and prestressed concrete structures history of prestressing construction materials: concrete, tendons, ducts, anchorage systems construction: prestressing methods prestressing forces and member forces (friction, elongation) tendon layout time dependant prestressing losses design of prestressed structures design of anchorage region non-bonded prestressing prestressed flat slabs Content Concrete bridges history of bridges design of bridges loads on bridges loads on bridges member forces for slab, T-beam, hollow box, frame and arch bridges precast bridges - precast segmental bridges	Lecturer	Prof. Günter Rombach
prestressed structures	Language	DE
basis of prestressed structures differences between reinforced and prestressed concrete structures history of prestressing construction materials: concrete, tendons, ducts, anchorage systems construction: prestressing methods prestressing forces and member forces (friction, elongation) tendon layout time dependant prestressing losses design of prestressed structures design of anchorage region non-bonded prestressing prestressed flat slabs Concrete bridges history of bridges design of bridges loads on bridges loads on bridges member forces for slab, T-beam, hollow box, frame and arch bridges precast bridges - precast segmental bridges	Cycle	SoSe
	Content	 basis of prestressed structures differences between reinforced and prestressed concrete structures history of prestressing construction materials: concrete, tendons, ducts, anchorage systems construction: prestressing methods prestressing forces and member forces (friction, elongation) tendon layout time dependant prestressing losses design of prestressed structures design of anchorage region non-bonded prestressing prestressed flat slabs Concrete bridges history of bridges design of bridges loads on bridges member forces for slab, T-beam, hollow box, frame and arch bridges
I ● Vorigeungeumgruck	Literature	 Vorlesungsumdruck Rombach, G. (2003): Spannbetonbau. Ernst & Sohn, Berlin Wicke, M. (2002): Anwendung des Spannbetons. Betonkalender 2002, Teil II, S. 113 180, Verlag Ernst & Sohn, Berlin Leonhardt, F. (1980): Vorlesungen über Massivbau. Teil 5: Spannbeton. Berlin Mehlhorn, G. (2007): Handbuch Brücken, Springer Verlag Schäfer, H.; Kaufeld, K. (1997): Massivbrücken. Betonkalender Teil II, S. 443ff, Ernst Sohn, Berlin Menn, Ch. (1986): Stahlbetonbrücken. Springer Verlag, Wien



Course L0604: Design of Prestressed Structures and Concreet Bridges	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0756: S	Soil Mechanics and	-Dynamics			
module moreo. e		Dynamios			
Courses					
Title		7		Hrs/wk	СР
Soil Mechanics - Selected	d Topics (L0374)		ecture.	2	2
Soil Dynamics (L0452)		L	ecture	3	2
Experimental Researches	s in Geotechnics (L0706)	F	Practical Course	1	2
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	INONE				
Recommended	modules: Mathematics I-I	II, Mechanics I-II, Geote	echnics I		
	courses: Soil laboratory c	course, (Applied structu	ıral dynamics)		
Educational Objectives	After taking part successi	After taking part successfully, students have reached the following learning results			
Professional					
Competence	After the successful comp	oletion of the module th	e students should	he able to:	
	·				
	1	pply the basic equation			
	 to understand the wave propagation in the soil under dynamic excitation and to detect the relevant parameters, 				
	 to know the essential laboratory and field tests to determine soil dynamic 				
	characteristics and to evaluate them,				
	_	e foundations to dynam s to perform vibration f			
		s in term to their effect		dinas.	
		oilities of isolation,		3 /	
		chanisms that cause e	arthquakes and ev	aluate earthqu	uake in term o
Knowledge	-	•	e capacity integrit	v and the dvn	namic bedding
	 to know methods to determine axial pile capacity, integrity and the dynamic bedding modulus, 				
		anisms that lead to a c		ulation due to	cyclic loading
		ese deformations math ne area of application	•	d of plactor	lynamics and
	plastodynamics,	ie area or application	on or the metho	u oi eiasioc	iyilalilics alic
		ained shear strength a			
	-	 to capture the visous behaviour of cohesive soils and to consider the effects of creep and rate-dependent shear strength in calculations, 			
	1	pact of the partly satura		and shear stre	ength.
CL:II-	<u> </u> 				
Skills Personal	-				
Competence					
Social Competence	-				
Autonomy	į				
Workload in Hours	Independent Study Time	96, Study Time in Lect	ure 84		
Credit points	6				
	Compulsory Bonus	Form	Descri	ption	
Studienleistung	Yes 15 %	Subject theoretic	cal and		
		practical work			
Examination	Oral exam				
	i				



Examination duration and scale	
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Course L0374: Soil Me	Course L0374: Soil Mechanics - Selected Topics		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Hans Mathäus Stanford		
Language	DE		
Cycle	SoSe		
Content	selected topis: - continuum mechanis - constitutive modelling - time and rate dependend material behavior of soils - cyclic loading - undrained conditions		
Literature	Kolymbas D. (2007): Geotechnik - Bodenmechanik, Grundbau und Tunnelbau. Springer Verlag		



Course L0452: Soil Dy	namics
Тур	Lecture
Hrs/wk	3
СР	2
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42
Lecturer	Dr. Sascha Henke
Language	DE
Cycle	SoSe
	mass-spring-damper systems,
	• wave propagation in soils,
	a dynamic poil parameters
	dynamic soil parameters,
	Determination of dynamic soil parameters,
	machine foundations,
Content	• in-situ measurement of ground motion, ground motion prediction, evaluation of ground motion,
	• ground motion shielding,
	• introduction into earthquake engineering,
	dynamic pile tests,
	cyclic accumulation,
	• plastodynamics
Literature	 Das B.M.: Fundamentals of Soil Dynamics, Elsevier Empfehlungen des Arbeitskreises Baugrunddynamik. Hrsg. Deutsche Gesellschaft für Geotechnik (DGGT) Haupt W.: Bodendynamik. Vieweg und Teubner Meskouris K. und Hinzen KG.: Bauwerke und Erdbeben. Vieweg Verlag Studer J.A., Koller M.G. und Laue J.: Bodendynamik, Springer Verlag





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Descriptio	on	
cr	challenging comp ms can be identi e 56 Description	Description ering: Elective Compulsory ineering: Elective Compulsory



	Computational Science and Engineering: Specialisation Scientific Computing: Elective		
	Compulsory		
Assignment for the	Mechanical Engineering and Management: Specialisation Product Development and		
Following Curricula	Production: Elective Compulsory		
	Mechatronics: Specialisation System Design: Elective Compulsory		
	Product Development, Materials and Production: Core qualification: Elective Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory		
	Theoretical Mechanical Engineering: Core qualification: Elective Compulsory		
	Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory		

Course L0523: Boundary Element Methods	
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Otto von Estorff
Language	EN
Cycle	SoSe
Content	- Boundary value problems - Integral equations - Fundamental Solutions - Element formulations - Numerical integration - Solving systems of equations (statics, dynamics) - Special BEM formulations - Coupling of FEM and BEM - Hands-on Sessions (programming of BE routines) - Applications
Literature	Gaul, L.; Fiedler, Ch. (1997): Methode der Randelemente in Statik und Dynamik. Vieweg, Braunschweig, Wiesbaden Bathe, KJ. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin

Course L0524: Bounda	Course L0524: Boundary Element Methods	
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Otto von Estorff	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



	Modeling in Water Management			
Courses				
Title Applied Groundwater Mod Applied Groundwater Mod Modeling of Water Supply		Typ Lecture Recitation Section (small) Project-/problem-based	Hrs/wk 1 2	CP 1 2
iviodeling of water Supply	and Gewer Network (L0073)	Learning		<u> </u>
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	Groundwater	structures, in particular drin special structures v systems and sewer system		er systemsar
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence Knowledge	The students are able to describe the modelling of groundwater flow and transport as well as urban water infrastructures. They can carry out systems analyses and can detect technical and conceptual weak points within the systems in case studies. Besides they are able to analyse			
Skills	The students are able to construct and apply scientific groundwater models indipendently They can work on different scenarios and can compare or assess different solutions to existing problems by application of selected software products. The students are able to use different software solutions (e.g. EPANET, EPA-SWMM).			
Personal Competence				
Social Competence	! N/i wal mi alak wa waaista It			
Autonomy	Wird nicht vermittelt.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	· · · · · · · · · · · · · · · · · · ·			
Studienleistung	None			
Examination				
Examination duration and scale	20 min			
	Civil Engineering: Specialisation Structura Civil Engineering: Specialisation Geotech			ry



Assignment for the Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Following Curricula Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory

Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0543: Applied	Course L0543: Applied Groundwater Modeling	
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Sonja Schröter	
Language	DE/EN	
Cycle	SoSe	
Content	Introduction and application of the groundwater model MODFLOW (PMWIN); theoretical backround of the modell, students do work with the model PMWIN for practical case studies.	
Literature	MODFLOW-Handbuch Chiang, Wen Hsien: PMWIN	

Course L0544: Applied	Course L0544: Applied Groundwater Modeling	
Тур	Recitation Section (small)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Sonja Schröter	
Language	DE/EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0875: Modelii	Course L0875: Modeling of Water Supply and Sewer Network	
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Klaus Johannsen, Weitere Mitarbeiter	
Language	DE	
Cycle	SoSe	
Content		
Literature	Mutschmann/Stimmelmayr: Taschenbuch der Wasserversorgung, 16. Auflage. Springer Vieweg - Verlag. Wiesbaden 2014.	



Courses				
Title Noise Protection (L1109)		Typ Lecture	Hrs/wk	CP 2
Project-/problem-based		2	4	
Module Responsible	Dr. Dorothea Rechtenbach			
Admission Requirements	None			
Recommended Previous Knowledge	 Knowledge on Urban planning Knowledge on measures for climate General knowledge of scientific wr 	•		
Educational Objectives	After taking part successfully, students have	re reached the following lea	ırning resul	ts
Professional Competence				
Knowledge	Students can describe urban development corridors as well as current and future urban environmental problems. They are able to explain the causes of environmental problems (like noise). Students can specify applications for various technical innovations and explain why these contribute to the improvement of urban life. They can, for example, derive and discuss measures for effective noise abatement.			
Skills	Students are able to develop specific solutions for correcting existing or future environment-related problems of urban development. They can define a range of conceptual and technical solutions for environmental problems for different development paths. To solve specific urban environmental problems they can select technical innovations and integrate them into the urban context.			
Personal Competence				
Social Competence	The students can work together in internat	ional groups.		
Autonomy	Students are able to organize their work flow to prepare themselves for presentations and contributions to the discussions. They can acquire appropriate knowledge by making enquiries independently.			
Workload in Hours	Independent Study Time 124, Study Time	in Lecture 56		
Credit points				
Studienleistung				
	Written elaboration			
Examination duration and scale	I Written Report blus oral Presentation			
Assignment for the Following Curricula				



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise Protection		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Martin Jäschke	
Language	EN	
Cycle	SoSe	
Content		
Literature	 Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) WHO (1999): Guidelines for Community Noise Environmental Noise Directive 2002/49/EG ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation 	

Course L0874: Urban Infrastructures	
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Dr. Dorothea Rechtenbach
Language	EN
Cycle	SoSe
Content	Problem Based Learning Main topics are: Central vs. Decentral Wastewater Treatment. Compaction of Cities. Car Free Cities. Multifunctional Places in Cities. The Sustainability of Freight Transport in Cities.
Literature	Depends on chosen topic.



Module M0859: C	Coastal Hydraulic Engineering II			
Courses				
Title		Тур	Hrs/wk	СР
Coastal- and Flood Protect		Lecture Project-/problem-based	2	3
Coastal- and Flood Protect		Learning	1	1
Maintennance and Defend	ce of Flood Protection Structures (L1411)	Lecture	2	2
Module Responsible				
Admission Requirements	INONE			
Recommended Previous Knowledge	I (`cactal Engineering I			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	The students have the capability to define and explain in detail the important aspects of erosion protection and flood protection and are able to apply the aspects to practical coastal protection problems. They are able to design and dimension important coastal protection measures from the functional and from the constructional point of view.			
Skills	The students are able to select design approaches for the functional and constructional design of erosion and flood protection measures and apply these approaches to practical design tasks.			
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as the functional and constructive design of coastal and flood protection structures. Additionally, they will be able to work in team with engineers of other disciplines.			
Autonomy	The students will be able to independently extend their knowledge and apply it to new problems.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 130 min. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.			
Assignment for the Following Curricula	I IVII Engineering. Specialication (Eegtechnical Engineering, Elective (Compilicati			



Course L0808: Coastal- and Flood Protection	
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Other Concepst Calculation approaches and numerical models Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland
Literature	Vorlesungsumdruck Coastal Engineering Manual CEM

Course L1415: Coastal- and Flood Protection	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L1411: Mainte	ourse L1411: Maintennance and Defence of Flood Protection Structures		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Olaf Müller		
Language	DE		
Cycle	SoSe		
Content	 Dike protection Maintennance of flood protection measures 		
Literature	Vorlesungsumdruck		



Module M0860: H	larbour Engineering and H	arbour Planning		
Courses				
Title Harbour Engineering (L08	09)	Typ Lecture	Hrs/wk 2	CP 2
Harbour Engineering (L14	14)	Project-/problem-based Learning	1	2
Port Planning and Port Co	nstruction (L0378)	Lecture	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of coastal engineering			
Educational Objectives	After taking part successfully, student	ts have reached the following le	arning resu	lts
Professional Competence				
Knowledge	The students are able to define in details and to choose design approaches for the functional design of a port and apply them to design tasks. They can design the fundamental elements of a port.			
Skills	The students are able to select and apply appropriate approaches for the functional design of ports.			
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as th functional design of ports. Additionaly, they will be able to work in team with engineers of othe disciplines.			
Autonomy	The students will be able to independently extend their knowledge and apply it to new problems.			
Workload in Hours	Independent Study Time 110, Study	Time in Lecture 70		
Credit points				
Studienleistung				
	Written exam			
	The duration of the examination is 15 general understanding of the lecture			respect to the
_	Civil Engineering: Specialisation Stru Civil Engineering: Specialisation Geo Civil Engineering: Specialisation Coa International Management and Eng Compulsory Theoretical Mechanical Engineering	otechnical Engineering: Elective astal Engineering: Compulsory gineering: Specialisation II. C	e Compulson	ering: Electiv



Course L0809: Harbour Engineering			
Lecture			
2			
2			
Independent Study Time 32, Study Time in Lecture 28			
Prof. Peter Fröhle			
DE			
SoSe			
 Fundamentals of harbor engineering Maritime transportation and waterways engineering Ships Elements of harbors Harbor approaches and water-side harbor areas Terminal design and handling of cargo Quay-walls and piers Equipment of harbors Sluices and other special constructions Connection to inland transportation / inland waterway transportation Protection of harbors Breakwaters and Jetties Wave protection of harbors Fishery and other small harbors 			
Brinkmann, B.: Seehäfen, Springer 2005			

Course L1414: Harbour Engineering		
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Hrs/wk 2 CP 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Lecturer Frank Feindt Language DE Cycle SoSe Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures Part of Hamburg - Infrastructure and development	Тур	Lecture
Workload in Hours Lecturer Frank Feindt Language DE Cycle SoSe Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Povelopment of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures	Hrs/wk	2
Lecturer Language DE Cycle SoSe Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures	СР	2
Cycle SoSe Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures	Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Cycle Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures	Lecturer	Frank Feindt
 Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures 	Language	DE
 Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures 	Cycle	SoSe
 Preparation of areas Scour formation in front of shore structures 	Content	 Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures Port of Hamburg - Infrastructure and development Preparation of areas
	Literature	Vorlesungsumdruck, s. www.tu-harburg.de/gbt



Module M0861: N	Modelling of Hydraulic Engineeri	ng		
Courses				
Title		Тур	Hrs/wk	СР
Hydraulic Models (L0813)		Project-/problem-based Learning	1	1
Modelling of Waves (L081	2)	Project-/problem-based Learning	1	1
Modelling of Flow in Rivers	s and Estuaries (L0810)	Lecture	3	4
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Coastal Hydraulic Engineering I			
Educational Objectives	After taking part successfully, students have	reached the following lea	arning resu	lts
Professional Competence				
Knowledge	Students are able to define in detail the basic processes that are related to the modelling of flows in hydraulic engineering. Besides, they can describe the basic aspects of numerical modelling and actual numerical models for the simulation of flows and waves.			
Skills	Students are able to apply hydrodynamic-numerical models to practical hydraulic engineering tasks.			
Personal Competence				
Social Competence	The students are able to deploy their quadritionaly, they will be able to work in tear		mple appl	ied problems.
Autonomy	The students will be able to independen problems.	tly extend their knowled	lge and ap	oply it to new
Workload in Hours	Independent Study Time 110, Study Time ir	Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 3 hours. general understanding of the lecture conter			respect to the
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Civil Engineering: Specialisation Geotechni Civil Engineering: Specialisation Coastal E	ical Engineering: Elective	Compulso	ry



Course L0813: Hydraulic Models		
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE/EN	
Cycle	SoSe	
Content	 Fundamentals of hydraulic models Model laws Pi theorem of Buckingham Practical examples of hydraulic models 	
Literature	Strobl, Zunic: Wasserbau, Kap. 11 Hydraulische Modelle, Springer	

Course L0812: Modelling of Waves		
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE/EN	
Cycle	SoSe	
Content	 Waves, interactions with shallow water and constructions Wave theories Sea state and surges Development of waves Wave spectra Modelling of Waves / phase averaged and phase resolved models Application of a phase averaged model for wave prediction (SWAN) Application of phase resolved wave models (Mike) 	
Literature	Vorlesungsumdruck	



Course L0810: Modelling of Flow in Rivers and Estuaries		
Тур	Lecture	
Hrs/wk	3	
СР	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Dr. Edgar Nehlsen, Prof. Peter Fröhle	
Language	DE/EN	
Cycle	SoSe	
Content	 Initial conditions and boundary conditions Numerical Methods Time step procedure Finite differences Finite volumes 	
Literature	Vorlesungsskript	



Module M0874: \	Vastewater Systems			
Courses				
Title Wastewater Systems - C		Typ Lecture Recitation Section (large) Lecture Recitation Section (large)	2	CP 2 1 2 1
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	INONA			
Recommended Previous Knowledge	tua atras a rat	nd the key processes	involved in	wastewate
Educational Objectives	Latter taking part successfully students have re	eached the following lea	rning results	3
Professional Competence Knowledge	Students are able to outline key areas of the full range of treatment systems in waste water			
Skills	Students are able to pre-design and explair and the scope of their application in municipa			•
Personal Competence				
Social Competence	Social skills are not targeted in this module.			
Autonomy	Students are in a position to work on a subject. They can also present on this subject.	ct and to organize their v	work flow inc	dependently
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Studienleistung				
Examination	Written exam			
Examination duration and scale				
	Civil Engineering: Specialisation Structural Ercivil Engineering: Specialisation Geotechnical Civil Engineering: Specialisation Coastal Engineering: Specialisation Water and T Bioprocess Engineering: Specialisation Water and T Bioprocess Engineering: Specialisation A Compulsory Energy and Environmental Engineering: Specialisation Management and Engineering: Engineering: Elective Compulsory International Management and Engineering: Biotechnology: Elective Compulsory Process Engineering: Specialisation Encompulsory Process Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Specialisati	al Engineering: Elective of ineering: Elective Compineering: Elective Compineering: Elective Compineering: General Bioprocess ecialisation Environmental: Specialisation II. Encorporation II. Provironmental Process Engineering: Elective Calisation Water: Compul	Compulsory bulsory bulsory see Engineeri tal Engineeri ergy and Er cocess Engineerir ompulsory sory	ng: Elective ring: Elective nvironmenta neering and ng: Elective



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Wastev	water Systems - Collection, Treatment and Reuse
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	 •Understanding the global situation with water and wastewater •Regional planning and decentralised systems •Overview on innovative approaches •In depth knowledge on advanced wastewater treatment options for different situations, for end-of-pipe and reuse •Mathematical Modelling of Nitrogen Removal •Exercises with calculations and design
Literature	Henze, Mogens: Wastewater Treatment: Biological and Chemical Processes, Springer 2002, 430 pages George Tchobanoglous, Franklin L. Burton, H. David Stensel: Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy McGraw-Hill, 2004 - 1819 pages

Course L0943: Wastewater Systems - Collection, Treatment and Reuse	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0357: Advanced Wastewater Treatment		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Joachim Behrendt	
Language	DE	
Cycle	SoSe	
	Survey on advanced wastewater treatment	
	reuse of reclaimed municipal wastewater	
	Precipitation	
	Flocculation	
	Depth filtration	
Content	Membrane Processes	
	Activated carbon adsorption	
	Ozonation	
	"Advanced Oxidation Processes"	
	Disinfection	
	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003	
Literature	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987	
	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007	
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006	
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003	



Course L0358: Advance	ced Wastewater Treatment	
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Joachim Behrendt	
Language	DE	
Cycle	SoSe	
	Aggregate organic compounds (sum parameters)	
	Industrial wastewater	
	Processes for industrial wastewater treatment	
Content	Precipitation	
	Flocculation	
	Activated carbon adsorption	
	Recalcitrant organic compounds	
	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003	
Literature	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987	
	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007	
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006	
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003	



Courses	
Title City Planning (L1066)	Typ Hrs/wk CP Project-/problem-based 4 6 Learning
Module Responsible	Prof. Carsten Gertz
Admission Requirements	INONA
•	for "Principles of Urban Planning": none
	for "Designing Urban Streetscapes": some knowledge of transport planning, e.g. throutaking the undergraduate class "Transport Planning and Traffic Engineering"
Educational Objectives	I Atter taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to: use technical terms of urban planning. describe the main determinants of urban development. explain and compare different possibilities of how urban development can influenced. discuss requirements for public streetscapes. explain the importance of street design.
Skills	Students are able to: • read and analyze urban development concepts and designs for streetscapes • appraise such concepts in the context of competing requirements. • design, justify and reflect their own solutions for concrete examples.
Personal Competence	
Social Competence	 discuss intermediate results with each other. constructively accept feedback on their own work. provide constructive feedback to others.
Autonomy	Students are able to: independently complete a written report including drawings following a broadly p defined process. assess the consequences of their proposed solutions. independently acquire knowledge and apply this to new issues or problem areas.
Workload in Hours	I Independent Study Time 124, Study Time in Lecture 56



Credit points	6
Studienleistung	None
Examination	Written elaboration
Examination duration and scale	I written assignment, designwork during the semester
Assignment for the Following Curricula	II odistics intrastructure and Mobility. Specialisation intrastructure and Mobility. Electivel

Course L1066: City Pla	anning
Тур	Project-/problem-based Learning
Hrs/wk	4
СР	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	SoSe
Content	"Principles of Urban Planning" deals with the determinants of urban development and their interactions. Topics include: • legal framework, • instruments and methods of planning, • functional requirements, • stakeholders and actors • basic design requirements • different planning levels and • historical contexts. The objective of the course is for students to acquire a basic understanding of urban development problems and approaches for solving them. They will also be able to comprehend the process of urban planning. The course also covers the various functional and aesthetic requirements for designing streetscape as the most important elements of public space. The project work deals with a real life scenario and includes drawing up a development plan, an urban design concept, a building masterplan and a street redesign.
Literature	Albers, Gerd; Wekel, Julian (2009) Stadtplanung: Eine illustrierte Einführung. Primus Verlag. Darmstadt. Frick, Dieter (2008) Theorie des Städtebaus: Zur baulich-räumlichen Organisation von Stadt. Wasmuth-Verlag. Tübingen Jonas, Carsten (2009) Die Stadt und ihr Grundriss. Wasmuth-Verlag. Tübingen Kostof, Spiro; Castillo, Greg (1998) Die Anatomie der Stadt. Geschichte städtischer Strukturen. Campus-Verlag. Frankfurt/New York.



Module M0977: C	Construction Logistics and Pro	oject Management		
Courses				
Title Construction Logistics (L1 Construction Logistics (L1 Project Development and	1164)	Typ Lecture Recitation Section (small) Lecture	Hrs/wk 1 1	CP 2 2 1
Project Development and	Management (L1162)	Project-/problem-based Learning	1	1
Module Responsible	Prof. Heike Flämig			
Admission Requirements	None			
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, students ha	ave reached the following lea	rning resu	Its
Professional Competence				
Knowledge	 give definitions of the main terms management name advantages and disadvants explain characteristics of product their consequences for constructi differentiate constructions logistic 	ages of internal or external co s, demand and production of on specific supply chains	nstruction construction	logistics
Skills	carry out project life cycle assess apply methods and instruments o design supply and waste remova	of construction logistics of project development and ma of conflict management		ıt
Personal Competence				
Social Competence	 hold presentations in and for grou apply methods of conflict solving 	•	studies	
Autonomy	solve problems by holistic, system improve their creativity, negotiation methods of moderation in case st	on skills, conflict and crises so	olution ski	lls by applying
	Independent Study Time 124, Study Time	e in Lecture 56		
Credit points				
Studienleistung				
	Written elaboration			
Examination duration and scale	Iwo written papers with presentations			
	Civil Engineering: Specialisation Structur	ral Engineering: Elective Com	npulsory	



	Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory
Assignment for the	International Management and Engineering: Specialisation II. Civil Engineering: Elective
Following Curricula	Compulsory
	International Management and Engineering: Specialisation II. Logistics: Elective Compulsory
	Logistics, Infrastructure and Mobility: Specialisation Production and Logistics: Elective
	Compulsory
	Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective
	Compulsory

Course L1163: Constr	uction Logistics
Тур	Lecture
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heike Flämig
Language	DE
Cycle	SoSe
Content	The lecture gives deeper insight how important logistics are as a competetive factor for construction projects and which issues are to be adressed. The following toppics are covered:
Literature	Flämig, Heike: Produktionslogistik in Stadtregionen. In: Forschungsverbund Ökologische Mobilität (Hrsg.) Forschungsbericht Bd. 15.2. Wuppertal 2000. Krauss, Siri: Die Baulogistik in der schlüsselfertigen Ausführung, Bauwerk Verlag GmbH Berlin 2005. Lipsmeier, Klaus: Abfallkennzahlen für Neubauleistungen im Hochbau: Verlag Forum für Abfallwirtschaft und Altlasten, 2004. Schmidt, Norbert: Wettbewerbsfaktor Baulogistik. Neue Wertschöpfungspotenziale in der Baustoffversorgung. In: Klaus, Peter: Edition Logistik. Band 6. Deutscher Verkehrs-Verlag. Hamburg 2003. Seemann, Y.F. (2007): Logistikkoordination als Organisationseinheit bei der Bauausführung Wissenschaftsverlag Mainz in Aachen, Aachen. (Mitteilungen aus dem Fachgebiet Baubetrieb und Bauwirtschaft (Hrsg. Kuhne, V.): Heft 20)



Course L1164: Constr	uction Logistics
Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heike Flämig
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1161: Project	Development and Management
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei
Language	DE
Cycle	SoSe
Content	Within the lecture, the main aspects of project development and management are tought: • Terms and definitions of project management • Advantages and disadvantages of different ways of project handling • organization, information, coordination and documentation • cost and fincance management in projects • time- and capacity management in projects • specific methods and instruments for successful team work Contents of the lecture are deepened in special exercises.
Literature	Projektmanagement-Fachmann. Band 1 und Band 2. RKW-Verlag, Eschborn, 2004.

Course L1162: Project	Development and Management
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0998: S	Statics and Dynamics of Structure	s		
Courses				
Title		Тур	Hrs/wk	СР
Structural Dynamics (L12	02)	Lecture	2	2
Structural Dynamics (L12	•	Recitation Section (large)	2	2
	fatigue in steel structures (L0564)	Lecture	1	1
Fracture Mechanics and I	Fatigue (L0565)	Recitation Section (large)	1	1
Module Responsible	Prof. Uwe Starossek			
Admission Requirements	INONA			
Recommended Previous Knowledge	Knowledge of linear structural analysis of stat Mechanics I/II, Mathematics I/II, Differential equ	-	indetermina	ate structures
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning resul	ts
Professional				
Competence				
	After successful completion of this module, the student can explain the basic aspects dynamic effects on structures and the respective methods.		sic aspects o	
Knowledge	After successful completion of this module, the material and structures to dynamics loading u and methods.		•	•
Skills Personal Competence				
Competence	I Students can			
Social Competence	participate in subject-specific and inter	f others colleagues		
Autonomy	Students are able to gain knowledge of the apply it to new problems. Furthermore, they problems in the area of Structural Analysis.	-		
Workload in Hours	Independent Study Time 96, Study Time in Le	cture 84		
Credit points	6			
Studienleistung				
	Written exam			
Examination duration and scale	150 min			
Assignment for the	Civil Engineering: Specialisation Structural En Civil Engineering: Specialisation Geotechnica Civil Engineering: Specialisation Coastal Engi	I Engineering: Elective	•	у



Following Curricula Civil	Engineering: Specialisation Water an	nd Traffic: Elective Compulsory	
Intern	ational Management and Enginee	ring: Specialisation II. Civil En	gineering: Elective
Comp	oulsory		

Course L1202: Structu	ıral Dynamics
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	SoSe
Content	 Single-degree-of-freedom systems: undamped and damped vibration, free vibration, forced vibrations due to harmonic, periodical or arbitrary loading, natural frequency, damping vibration isolation solution in the frequency-domain (Fourier transformation), solution in the time-domain multi-degree-of-freedom systems: continuous or discrete systems, modelling with finite elements, generalisation modal analysis power iteration according to v.Mises earthquake loading: seismological basics, response spectrum method wind-induced vibrations: engineering meteorology, aerodynamic, classification of excitation mechanisms progressive collapse
Literature	Clough, R.W., Penzien, J.: Dynamics of Structures. 2. Aufl., McGraw-Hill, New York, 1993.

Course L1203: Structu	Course L1203: Structural Dynamics	
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



11/n	Lecture
Hrs/wk	
CP	
	Independent Study Time 16, Study Time in Lecture 14
	Dr. Ingo Hadrych
Language	
Cycle	
·	basics of fatigue stress and fatigue resistance and determination of fatigue strength,
	determination anduse of S-N-curves and classification of notch effects,
	 set up of determination of fatigue strength under dynamic load using the accumulate formula by Palmgren-Miner,
Content	• set up of determination of fatigue strength in different examples,
	basics of construction and design regarding the problem of material fatigue,
	basics of linear elastic fracture mechanics under static and dynamic load,
	 determination of lifetime of steel construction based on linear elastic fracture mechanics different examples.
Literature	 Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 200 Verlag Ernst & Sohn; Berlin 2003 Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Auflag Stahlbau-Verlagsgesellschaft; Köln 1996 Petersen, C.; Stahlbau; 3. überarb. und erw. Auflage; Vieweg-Verlag; Braunschweig 1993 DIN V ENV 1993-1-1: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993 DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil Kranbahnen; 2001 DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; National Anwendungsdokument (NAD); Berlin 2002



Course L0565: Fracture Mechanics and Fatigue		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Ingo Hadrych	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0999: S	Steel Construction Pro	ject			
Courses					
Title		Тур	Hrs/wk	СР	
Steel Construction Project	t (L1206)	Project Seminar	4	6	
Module Responsible	Prof. Marcus Rutner				
Admission Requirements	INODA				
Recommended Previous Knowledge	I STADI AND L'AMNOSTE STRICTURE	es			
Educational Objectives	I ATTOR TOKING NORT CHICCOCCTIIIIV	students have reached the followin	g learning resu	lts	
Professional Competence					
Knowledge	Students are able to prepare a	a part of the whole project and expl	ain it to the othe	ers.	
Skills	Students can produce sketches and calculations of their part of the project. They are able to adjust their work in reaction to changing conditions resulting from other participants of the project.				
Personal					
Competence	i	ults to other members of the group.			
Social Competence	They have the ability to work for a broad agreement with respect to intergroup dependencies.				
,		They can distribute and process tasks independently.			
Autonomy	Students can handle their part	t of the project on their own resposi	bility-		
Workload in Hours	Independent Study Time 124,	Study Time in Lecture 56			
Credit points	6				
Studienleistung	None				
Examination	Written elaboration				
Examination duration and scale	Lannrox 15-20 pages (without	appendix)			
Assignment for the Following Curricula	Civil Engineering: Specialisati	ion Geotechnical Engineering: Election Coastal Engineering: Elective Coon Structural Engineering: Compu	Compulsory	ry	

Course L1206: Steel C	Course L1206: Steel Construction Project			
Тур	Project Seminar			
Hrs/wk	4			
СР	6			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Lecturer	Prof. Marcus Rutner			
Language	DE			
Cycle	SoSe			
Content	Design of a big construction project (i.e skyscraper, large bridge, roof of a stadiuim) in small groups			
Literature	Wird je nach Projekt individuell angegeben.			



Module M0663: N	larine Geotechnics and Numerics				
Courses					
Title	7	 Гур	Hrs/wk	СР	
Marine Geotechnics (L05		Lecture	1	2	
Marine Geotechnics (L05	49) F	Recitation Section (large)	1	1	
Numerical Methods in Ge	otechnics (L0375)	ecture	3	3	
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	None				
Do como mo o mado d	complete modules: Geotechnics I-II, Mathematic	os I-III			
Recommended Previous Knowledge	courses: Soil laboratory course				
Educational Objectives	After taking part successfully, students have reached the following learning results				
Professional					
Competence					
Knowledge					
Skills					
Personal					
Competence					
Social Competence					
Autonomy	Indonesia de la Childri Timo 110 Childri Timo in Lea	-t 70			
	Independent Study Time 110, Study Time in Lec	clure 70			
Credit points					
Studienleistung					
Examination					
Examination duration and scale	90 min				
Assignment for the Following Curricula	II Omnilleon/				



Course L0548: Marine	Geotechnics
Тур	Lecture
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	 Geotechnical investigation an description of the seabed Foundations of Offshore-Constructions cCliff erosion Sea dikes Port structures Flood protection structures
Literature	 EAK (2002): Empfehlungen für Küstenschutzbauwerke EAU (2004): Empfehlungen des Arbeitsausschusses Uferbauwerke Poulos H.G. (1988): Marine Geotechnics. Unwin Hyman, London Wagner P. (1990): Meerestechnik: Eine Einführung für Bauingenieure. Ernst & Sohn, Berlin

Course L0549: Marine Geotechnics		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0375: Numer	ical Methods in Geotechnics
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Hans Mathäus Stanford
Language	DE
Cycle	SoSe
Content	Topics: numerical simulations numerical algorithms finite element method application of finite element method in geomechanics constitutive models for soils contact models for soil structure interaction selected applications
Literature	 Wriggers P. (2001): Nichtlineare Finite-Elemente-Methoden, Springer Verlag, Berlin Bathe Klaus-Jürgen (2002): Finite-Elemente-Methoden. Springer Verlag, Berlin



Module M0581: V					
Courses					
Title		Тур	Hrs/wk	СР	
	stewater Management (L0226)	Lecture	3	3	
	stewater Management (L2008)	Project Seminar	3	3	
Module Responsible	·				
Admission Requirements	None				
Recommended Previous Knowledge					
Educational Objectives	After taking part successfully, stude	ents have reached the following	ı learning resu	Its	
Professional					
Competence		ania mainainian afaka wasaniata			
Knowledge	The students can describe the basic principles of the regulatory framework related to the international and European water sector. They can explain limnological processes, substance cycles and water morphology in detail. They are able to assess complex problems related to water protection, such as ecosystem service and wastewater treatment with a special focus or innovative solutions, remediation measures as well as conceptual approaches.				
Skills	Students can accurately assess current problems and situations in a country-specific or loca context. They can suggest concrete actions to contribute to the planning of tomorrow's urbar water cycle. Furthermore, they can suggest appropriate technical, administrative and legislative solutions to solve these problems.				
Personal					
Competence					
	The students can work together in international groups.				
0 : 10 .					
Social Competence					
	Students are able to organize their work flow to prepare presentations and discussions. The can acquire appropriate knowledge by making enquiries independently.				
Autonomy					
Workload in Hours	Independent Study Time 96, Study	Time in Lecture 84			
Credit points	6				
Studienleistung	None				
Examination	Written exam				
Examination duration	60 min				
and scale					



Assignment for the Following Curricula	Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory
Ü	Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory
	Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Compulsory

Course L0226: Water I	Protection and Wastewater Management
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 Regulatory Framework (e.g. WFD) Main instruments for the water management and protection In depth knowledge of relevant measures of water pollution control Urban drainage, treatment options in different regions on the world Rainwater management, improved management of heavy rainfalls, downpours, rainwater harvesting, rainwater infiltration Case Studies and Field Trips
Literature	 The literature listed below is available in the library of the TUHH. Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International. Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011) New York, NY: McGraw-Hill. Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Course L2008: Water Protection and Wastewater Management		
Тур	Project Seminar	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Ralf Otterpohl	
Language	EN	
Cycle	WiSe	
Content		
Literature		



Module M0595: E	xamination of Mater	ials, Structura	I Condition and I	Damages	
Courses					
	Structural Condition and Damaç Structural Condition and Damaç	ges (L0260)	Typ Lecture Recitation Section (small)	Hrs/wk 4 1	CP 4 2
Module Responsible	Prof. Frank Schmidt-Döhl				
Admission Requirements	None				
	Basic knowledge about bu Building Materials and Buil		material science, for	example by	the module
Educational Objectives	After taking part successfull	y, students have re	ached the following lea	rning results	;
Professional Competence					
Knowledge	The students are able to products in Germany. They are usable and know the lin	know which metho	ds for the testing of bui	lding materi	al properties
Skills	The students are able to responsibly discover the rules for trading and using of building products in Germany. They are able to chose suitable methods for the testing and inspection of construction products, the examination of damages and the examination of the structural conditions of buildings. They are able to conclude from symptons to the cause of damages. They are able to describe an examination in form of a test report or expert opinion.				
Personal Competence					
Social Competence	The students can describe the different roles of manufacturers as well as testing, supervisory and certification bodies within the framework of material testing. They can describe the different roles of the participants in legal proceedings.				
Autonomy	The students are able to knowledge of a very extens		nd the operation steps	s to learn th	ne specialist
Workload in Hours	Independent Study Time 11	0, Study Time in Le	ecture 70		
Credit points					
Studienleistung					
Examination	Written exam				
Examination duration and scale	120 min				
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Materials Science: Specialisation Engineering Materials: Elective Compulsory				



Course L0260: Examination of Materials, Structural Condition and Damages		
Тур	Lecture	
Hrs/wk	4	
СР	4	
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	WiSe	
Content	Materials testing and marking process of construction products, testing methods for building materials and structures, testing reports and expert opinions, describing the condition of a structure, from symptons to the cause of damages	
Literature	Frank Schmidt-Döhl: Materialprüfung im Bauwesen. Fraunhofer irb-Verlag, Stuttgart, 2013.	

ourse L0261: Examination of Materials, Structural Condition and Damages	
Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1350: E	Excavation Law and Projects			
0				
Courses				
Title	F (1.0005)	Тур	Hrs/wk	CP
Subsoil and Underground Service Contract and Pro-		Lecture Lecture	2	2
	, ,	Project-/problem-based	_	_
Project Geotechnics (L07	08)	Learning	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional				
Competence				
Knowledge				
Skills				
Personal				
Competence				
Social Competence				
Autonomy				
	Independent Study Time 96, Study Time in	Lecture 84		
Credit points				
Studienleistung	None			
Examination	Oral exam			
Examination duration and scale	I15 min			
Assignment for the Following Curricula	Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory			



Course L0395: Subsoi	and Underground Engineering Law
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Georg-Friedger Drewsen
Language	DE
Cycle	WiSe
Content	 Introduction Historical Overview Areas of civil law The Contracting Parties Authorities, Cooperatioves and other patries involved The Civil law The Public Service Obligations Land acquisition Planning of underground construction projects The construction contract according to BGB/VOB - design and implementation The civil law in the jurisdiction
Literature	Folienskipt (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner- Verlag

Course L1906: Service	ourse L1906: Service Contract and Procurement Law	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Günther Schalk, Prof. Jürgen Grabe	
Language	DE	
Cycle	WiSe	
Content		
Literature		



Course L0708: Project Geotechnics	
Тур	Project-/problem-based Learning
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	The students solve independently a project-based geotechnical problem in groups. Additional lectures concerning the problem will be held and material will be distributed as study basis. Every two weeks the groups present their current project status. The final work will be presentated in a final presentation.
Literature	abhängig von der Fragestellung



Courses					
Title Waste and Environmental	Chemistry (L0328)		Typ Practical Course	Hrs/wk 2	CP 2
Biological Waste Treatme	nt (L0318)		Project-/problem-based Learning	3	4
Module Responsible	Prof. Kerstin Kuchta				
Admission Requirements	None				
Recommended Previous Knowledge	chemical and biological b	pasics			
Educational Objectives	After taking part successf	ully, students have re	ached the following lea	rning resul	ts
Professional Competence					
Knowledge	The module aims possess knowledge concerning the planning of biological waste treatment plants. Students are able to explain the design and layout of anaerobic and aerobic waste treatment plants in detail, describe different techniques for waste gas treatment plants for				
Skills	The students are able to discuss the compilation of design and layout of plants. They car critically evaluate techniques and quality control measurements. The students can recherche and evaluate literature and date connected to the tasks given in der module and plar additional tests. They are capable of reflecting and evaluating findings in the group.				
Personal Competence	Students can narticinat	ta in subject specifi	e and interdisciplinar	v discussi	ons develo
Social Competence	Students can participate in subject-specific and interdisciplinary discussions, development development in front of colleagues. Furthermore, they can give and acceptorofessional constructive criticism.				
Autonomy	Students can independently tap knowledge from literature, business or test reports and transform it to the course projects. They are capable, in consultation with supervisors as well as in the interim presentation, to assess their learning level and define further steps on this basis. Furthermore, they can define targets for new application-or research-oriented duties in accordance with the potential social, economic and cultural impact.				
Workload in Hours	Independent Study Time	110, Study Time in Le	ecture 70		
Credit points	6				
Studienleistung	Compulsory Bonus Yes None	Form Subject theoret	Descriptio ical and	on	
Evamination		practical work			
Examination					
Examination duration	Elaboration and Presenta				



Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Core qualification: Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Energy: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory
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Course L0328: Waste and Environmental Chemistry		
Тур	Practical Course	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Kerstin Kuchta	
Language	DE/EN	
Cycle	WiSe	
Content	The participants are divided into groups. Each group prepares a transcript on the experiment performed, which is then used as basis for discussing the results and to evaluate the performance of the group and the individual student. In some experiments the test procedure and the results are presented in seminar form, accompanied by discussion and results evaluation. Experiments ar e.g. Screening and particle size determination Fos/Tac AAS Chalorific value	
Literature	Scripte	



Course L0318: Biological Waste Treatment			
Тур	Project-/problem-based Learning		
Hrs/wk	3		
СР	4		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42		
Lecturer	Prof. Kerstin Kuchta		
Language	EN		
Cycle	WiSe		
Content	 Introduction biological basics determination process specific material characterization aerobic degradation (Composting, stabilization) anaerobic degradation (Biogas production, fermentation) Technical layout and process design Flue gas treatment Plant design practical phase 		
Literature			



Module M0705: G	Groundwater			
Courses				
Title Geohydraulic and Solute		Typ Lecture	2	CP 2
Geohydraulic and Solute Simulation in Groundwate		Recitation Section (small) Lecture	_	1 1
Simulation in Groundwate		Recitation Section (small)		2
Module Responsible	NN			
Admission Requirements	INANA			
Recommended Previous Knowledge	,			
Educational Objectives	LATTER TAKING NART SLICCESSTULIV STUDENTS NAVE I	reached the following lea	rning results	
Professional Competence				
Knowledge	The students are able to describe the fate of solutes in the subsurface along the path between soil and water body quantitatively and qualitatively. They are able to do this with simulation models.			
Skills	The students are able to describe conceptually movement and storage of water in the unsaturated zone. They are able to analyse pF- functions and Ku functions. They can mode transport of solutes in the unsaturated and saturated zoned. They are able to determine dispersiities, sorption coefficients, decay rates and dissolution rates for organic and inorganic substances.			
Personal Competence				
Social Competence	The students can help to each other.			
Autonomy	none			
Workload in Hours	Independent Study Time 96, Study Time in L	ecture 84		
Credit points	6			
Studienleistung				
	Written exam			
Examination duration and scale	60 min written exam and written papers			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural E Civil Engineering: Specialisation Geotechnic Civil Engineering: Specialisation Coastal En Civil Engineering: Specialisation Water and Process Engineering: Specialisation E Compulsory Process Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Water And Environmental Engineering: Specialisation Water And Environmental Engineering: Specialisation Process Proc	cal Engineering: Elective of gineering: Elective Comp Traffic: Elective Compulson vironmental Process s Engineering: Elective Compulsion Water: Compulsialisation Water: Compulsialisation Environment: E	Compulsory bulsory bulsory bry Engineering ompulsory sory	



Course L0539: Geohy	ourse L0539: Geohydraulic and Solute Transport	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Wilfried Schneider	
Language	DE	
Cycle	WiSe	
Content	Pump test analysis, water content-water suction functions, unsaturated hydraulic conductivity function, Brooks-Corey relation, van Genuchten relation, solute transport in unsaturated zone, solute transport and reactions in groundwater	
Literature	Todd; K. (2005): Groundwater Hydrology Fetter, C.W. (2001): Applied Hydrogeology Hölting & Coldewey (2005): Hydrogeologie Charbeneau, R.J. (2000): Groundwater Hydraulics and pollutant Transport	

Course L0540: Geohydraulic and Solute Transport		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wilfried Schneider	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0541: Simulation in Groundwater Hydrology	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Schröter
Language	DE
Cycle	WiSe
Content	Basics and theoretical background of simulation models frequently used in science and practise for pumping test analysis, water movement in vadose zone, solute transport in vadose zone, groundwater recharge, solute transport in groundwater
Literature	Handbücher der verwendeten Slumationsmodelle werden bereitgestellt.



Course L0542: Simulation in Groundwater Hydrology	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Schröter
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Madula M0712. (Concrete Structures			
Module Mo713: C	Concrete Structures			
Courses				
Title		Тур	Hrs/wk	СР
Concrete Structures (L05	·	Seminar	1	1
Structural Concrete Mem		Lecture	2	3
Structural Concrete Mem	bers (L0578)	Recitation Section	n (large) 2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	INOne			
D	Basics of structural analysis, conception and dimensioning of structural concrete			
Recommended Previous Knowledge	Modules 'Concrete Structures I a	and II'		
Educational Objectives	After taking part successfully, stu	dents have reached the follow	wing learning resu	Its
Professional Competence				
Knowledge	The students broaden their skills in structural engineering, especially in the field of buildings (houses, roofs, halls). They dispose of the knowledge for the conception and design of concrete buildings and structural members that are often used.			
Skills	The students are able to apply procedures of the conception and dimensioning to to practica problems of structural engineering. They are capable to draft concrete buildings and to design them for general action effects and to plan their detailing and execution. Moreover, they car make design and construction sketches and draw up technical descriptions.			
Personal				
Competence				
Social Competence	The students are able to obtain	esults of high quality in teamy	vork.	
Autonomy	The students are able to carry out complex conception and dimensioning tasks of structures under the guidance of tutors.			
Workload in Hours	Independent Study Time 110, S	udy Time in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	1120 minutes			
_	Civil Engineering: Specialisation Structural Engineering: Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective			

Compulsory



Course L0579: Concrete Structures	
Тур	Seminar
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	With help of a project teamwork the subjects of the course "Concrete Structures" is practiced, discussed and presented.
Literature	- Projektbezogene Unterlagen werden abgegeben.

Course L0577: Structural Concrete Members		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	 concrete buildings actions on structrues bracing systems slabs (line and point supported plates and floor slabs) membranes and deep beams shells and folded plates reinforced and prestressed members 	
Literature	- Vorlesungsunterlagen	

Course L0578: Structural Concrete Members	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0722: C	Computational Analysis of Concre	ete Structures		
Courses				
-	Concrete Structures (L0598) Concrete Structures (L0599)	Typ Lecture Recitation Section (large)	Hrs/wk 2 2	CP 2 2
FE-Modeling of Concrete	Structures (L0600)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
Recommended	Basic knowledge in structural analysis and design of reinforced concrete structures (beam slabs, shear walls). Lectures 'Concrete Structures I und II'		ures (beams,	
Previous Knowledge	Lectures 'Structural Analysis I and II' Lecture 'Concrete Structures'			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence		al modeling and design	of an arhit	rary concrete
Knowledge Skills	The students know the problems of numerical modeling and design of an arbitrary concrete structure. The students can model and design an arbitrary concrete structure by means of a finite element software package.			
Personal Competence				
Social Competence	The students can model and design in teamwork a real concrete structure by means of a finite element software package.			
Autonomy	The students can model and design a real concrete structure based on a finite element software package and discuss the problems and results with other students.			
Workload in Hours	Independent Study Time 96, Study Time in Le	cture 84		
Credit points				
Studienleistung				i
Examination Examination duration and scale				
Assignment for the	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory			



Course L0598: Compu	tational Analysis of Concrete Structures
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 Modeling of beam and truss structures Discontinuity regions, like frame corners, openings, shear walls with large openings Bracing of high-rise buildings Modeling of bridges Nonlinear analysis Finite-Elemente-analysis of slabs: support conditions, singularity regions Finite-Elemente-Berechnungen of shear walls and deep beams: support condition, design Coupled systems Modeling of slab supported on beams Shell structures 3D building models Nonlinear analysis of slabs and shells Documentation
Literature	 Vorlesungsumdruck Rombach, G.A. (2007): Anwendung der Finite-Elemente-Methode im Betonbau. 2. Auflage, Verlag Ernst & Sohn, Berlin Rombach G.A. (2011): Finite-Element Design of Concrete Structures, 2nd edition, ICE publishing Hartmann, F., Katz, C. (2002): Statik mit finiten Elementen. Springer, Berlin

Course L0599: Computational Analysis of Concrete Structures	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L0600: FE-Mod	deling of Concrete Structures
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Lukas Henze
Language	DE
Cycle	WiSe
Content	Finite Element Modeling and computational design of concrete structures by 'SOFiSTiK'
Literature	 Rombach G.: Anwendung der Finite - Elemente - Methode im Betonbau. 2. Auflage. Verlag Ernst &.Sohn, Berlin, 2007 Rombach G.: Finite-Element Design of Concrete Structures. 2nd edition, ICE Publishing, London, 2011, ISBN 0 7277 32749 Rombach G.: EDV-unterstützte Berechnungen im Stahlbetonbau. in: "Stahlbetonbau aktuell 2014" (ed. Gorris A., Hegger J., Mark P.), Berlin 2014 (S. C1C.36)



Module M0801: V	Vater Resources and -Supply			
Courses				
Title Chemistry of Drinking Wat Chemistry of Drinking Wat Water Resource Manager Water Resource Manager	ter Treatment (L0312) ment (L0402)	Typ Lecture Recitation Section (large) Lecture Recitation Section (small)	2	CP 1 2 2 1
Module Responsible	Prof. Mathias Ernst			
Admission Requirements	None			
Recommended Previous Knowledge	Knowledge of water management and the key	processes involved in v	water treatr	ment.
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning resul	ts
Professional Competence				
Knowledge	Students will be able to outline key areas of conflict in water management, as well as their mutual dependence for sustainable water supply. They will understand relevant economic, environmental and social factors. Students will be able to explain and outline the organisational structures of water companies. They will be able to explain the available water treatment processes and the scope of their application.			
Skills	Students will be able to assess complex problems in drinking water production and establish solutions involving water management and technical measures. They will be able to assess the evaluation methods that can be used for this. Students will be able to carry out chemical calculations for selected treatment processes and apply generally accepted technical rules and standards to these processes.			
Personal Competence				
Social Competence	Working in a diverse group of specialists, students will be able to develop and document complex solutions for the management and treatment of drinking water. They will be able to take an appropriate professional position, for example representing user interests. They will be able to develop joint solutions in teams of diverse experts and present these solutions to others.			
Autonomy	Students will be in a position to work on a subject independently and present on this subject.			
		Independent Study Time 96, Study Time in Lecture 84		
Credit points				
Studienleistung				
	Written exam			
Examination duration and scale	60 min (chemistry) + presentation			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Compulsory Energy and Environmental Engineering: Specialisation Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory			



Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0311: Chemistry of Drinking Water Treatment		
Тур	Lecture	
Hrs/wk	2	
СР	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dr. Klaus Johannsen	
Language	DE	
Cycle	WiSe	
	The topic of this course is water chemistry with respect to drinking water treatment and water distribution	
	Major topics are solubility of gases, carbonic acid system and calcium carbonate, blending, softening, redox processes, materials and legal requirements on drinking water treatment. Focus is put on generally accepted rules of technology (DVGW- and DIN-standards).	
Content	Special emphasis is put on calculations using realistic analysis data (e.g. calculation of pH or calcium carbonate dissolution potential) in exercises. Students can get a feedback and gain extra points for exam by solving problems for homework.	
	Knowledge of drinking water treatment processes is vital for this lecture. Therefore the most important processes are explained coordinated with the course "Water resources management" in the beginning of the semester.	
	MHW (rev. by Crittenden, J. et al.): Water treatment principles and design. John Wiley & Sons, Hoboken, 2005.	
	Stumm, W., Morgan, J.J.: Aquatic chemistry. John Wiley & Sons, New York, 1996.	
Literature	DVGW (Hrsg.): Wasseraufbereitung - Grundlagen und Verfahren. Oldenbourg Industrie Verlag, München, 2004.	
	Jensen, J. N. : A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.	

Course L0312: Chemistry of Drinking Water Treatment		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Dr. Klaus Johannsen	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0402: Water I	Resource Management	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Mathias Ernst	
Language	DE	
Cycle	WiSe	
Content	The lecture provides comprehensive knowledge on interaction of water ressource management and drinking water supply. Content overview: • Current situation of global water resources - User and Stakeholder conflicts - Wasserressourcenmanagement in urbane Gebieten - Rechtliche Aspekte, Organisationsformen Trinkwasserversorgungsunternehmen. - Ökobilanzierung, Benchmarking in der Wasserversorgung	
Literature	 Aktuelle UN World Water Development Reports Branchenbild der deutschen Wasserwirtschaft, VKU (2011) Aktuelle Artikel wissenschaftlicher Zeitschriften Ppt der Vorlesung 	

Course L0403: Water Resource Management		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Mathias Ernst	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Recommended Previous Knowledge Educational Objectives Professional Competence	Prof. Carsten Gertz None some knowledge of transport planning, e.g. through taking the undergraduate class "Transpo Planning and Traffic Engineerin After taking part successfully, students have reached the following learning results Students are able to:
Admission Requirements Recommended Previous Knowledge Educational Objectives Professional Competence	None some knowledge of transport planning, e.g. through taking the undergraduate class "Transpo Planning and Traffic Engineerin After taking part successfully, students have reached the following learning results Students are able to:
Requirements Recommended Previous Knowledge Educational Objectives Professional Competence	some knowledge of transport planning, e.g. through taking the undergraduate class "Transpo Planning and Traffic Engineerin After taking part successfully, students have reached the following learning results Students are able to:
Previous Knowledge Educational Objectives Professional Competence	Planning and Traffic Engineerin After taking part successfully, students have reached the following learning results Students are able to:
Objectives Professional Competence	Students are able to:
Competence	
Knowledge	 describe interdependencies between land-use/location choice ar transportation/mobility behaviour explain and evaluate the social, ecological and economic effects of transport and land use policy measures. relate current issues in the area of integrated transport planning and formulate a opinion on them.
Skills	 Quantify important parameters, which influence travel demand or are influenced by it. comprehensively examine a pre-defined or self-selected topic from a transportation studies perspective and document the results in accordance with scientic conventions.
Personal Competence	Students are able to:
Social Competence	 provide feedback on topical contents and their teaching. constructively handle feedback on their own work. produce results in group work and document these.
S	 Students are able to: assess potential consequences of their future professional activities independently plan working on a pre-defined project topic, acquire the necessa knowledge and use appropriate means for its execution.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points 6	6



Examination	Written elaboration	
Examination duration and scale	I written assignment with presentation during the semester	
Assignment for the	H odistics intrastructure and Modility. Specialisation intrastructure and Modility. Flectivel	

Course L1068: Integrated Transportation Planning		
Тур	Project-/problem-based Learning	
Hrs/wk	4	
СР	6	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß	
Language	DE	
Cycle	WiSe	
Content	The course will provide students with an understanding of interdependencies between landuse and transportation. Specific topics include a.o.: • interactions between transport and the environment and consequent limitations • characteristics of integrated planning • complex planning processes • interdependencies of location choice and mobility behaviour • transport and land-use policies • project on current issues in transportation studies	
Literature	Kutter, Eckhard (2005) Entwicklung innovativer Verkehrsstrategien für die mobile Gesellschaft. Erich Schmidt Verlag. Berlin. Bracher, Tilman u. a. (Hrsg.) (68. Ergänzung 2013) Handbuch der kommunalen Verkehrsplanung. Herbert Wichmann Verlag. Berlin, Offenbach. (Loseblattsammlung mit kontinuierlichen Ergänzungen)	



Module M0963: S	steel and Composite Structures			
Courses				
Title Steel and Composite Structure Steel and Composite Structure Steel and Composite Structure Structur		Typ Lecture Recitation Section (large)	Hrs/wk 2	CP 2 2
Steel Bridges (L1097)	33 (2.233)	Lecture	2	2
Module Responsible	Prof. Marcus Rutner			
Admission Requirements				
Recommended Previous Knowledge	Basics of steel construction (i.e. Steel Struct	ures I and II, BUBC)		
Educational Objectives	After taking part successfully, students have	reached the following lea	rning results	3
Professional Competence	After successful completition, students can			
Knowledge	 describe the phenomenon of local buckling explain warping torsion illustrate the behaviour of composite structures specify the principles in design of composite structures sketch the contructions of steel and composite bridges 			
Skills	After successful participation students are a check stiffened and unstiffened plate recognize and verify warping tosion design composite structures design bridges and o perform the design	ed structures in strucures		
Personal				
Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in	Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	180 min			
	Civil Engineering: Specialisation Structural Civil Engineering: Specialisation Geotechnic Civil Engineering: Specialisation Coastal Electric Engineering: Specialisation Water and International Management and Engineering Compulsory	ical Engineering: Elective ngineering: Elective Comp I Traffic: Elective Compulso	Compulsory oulsory ory	



Course L1204: Steel a	nd Composite Structures
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	WiSe
Content	 Local-buckling of plated structures Warping torsion Composite-girders, -columns, -slabs, -bridges Principles in composite constructions Bridge-design and -construction
Literature	Petersen, C.: Stahlbau, 4.Auflage 2013, Springer-Vieweg Verlag Minnert, J. Wagenknecht, G.: Verbundbau-Praxis - Berechnung und Konstruktion nach Eurocode 4, 2.Auflage 2013, Bauwerk Beuth Verlag

Course L1205: Steel and Composite Structures		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Marcus Rutner	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



ourse L1097: Steel B	Bridges
Тур	Lecture
Hrs/wk	2
СР	
	Independent Study Time 32, Study Time in Lecture 28
	Dr. Jörg Ahlgrimm
Language	
Сусіе	WiSe Lecture Contents ,Steel Bridge Construction' DrIng. Jörg Ahlgrimm
	- From tendering and contracting to completion - the development of a steel bridge
	- Contents of a bridge static - structural details, examples of analysis in detail:
	-> effective width in regard to the longitudinal stiffeners
	-> Bearing point, bearing stiffener
	-> Crossbeam breakthrough, crossbeam reinforcement
	-> Analysis of the Rib-to-Floorbeam (RF) connection (web-tooth of the floorbeam between trapezoidal shaped Ribs)
Content	- Steel grades, -designation, testing methods and approval certificates
	- Nondestructive weld inspecting
	- Corrosion protection
	- Bridge bearing - types, format, function, dimensioning, installation
	- Expansion Joints
	- Oscillation of bridge hangers and cables - oscillation damper
	- Opening bridges- Detailed reviews to different assembling procedures and - implements
	- Selective damage events
	Requirements: Basic knowledge in the calculation, dimensioning, and construction structural elements and joints of constructional steelwork
	Herbert Schmidt, Ulrich Schulte, Rainer Zwätz, Lothar Bär: Ausführung von Stahlbauten
Literature	Petersen, Christian: Stahlbau, Abschnitt Brückenbau
	 Ahlgrimm, J., Lohrer, I.: Erneuerung der Eisenbahnüberführung in Fulda-Horas üldie Fulda, Stahlbau 74 (2005), Heft 2, S. 114



Module M0969: S	elected Topics in Civil Engine	erina		
Wodale Woods. C	cicolou ropios in olvii Eligino	Cillig		
Courses				
Title		Tun	Hrs/wk	СР
Analysis of Offshore Struc	etures (I 1867)	Typ Lecture	nrs/wk	1
Design of Concrete Struct		Lecture	2	2
=	oncrete Structures (L0596)	Lecture	1	1
=	oncrete Structures (L0597)	Recitation Section (large)	•	1
	d Construction Management (L1634)	Seminar	1	1
	nd Construction Management (L1635)	Seminar	1	1
Timber Structures (L1151		Seminar	2	2
Glass Structures (L1152)	,	Lecture	2	2
Glass Structures (L1447)		Recitation Section (large)	1	1
Wind turbine design (L190	5)	Lecture	1	1
Module Responsible	Prof. Uwe Starossek			
Admission	None			
Requirements				
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, students ha	ve reached the following lea	rning resu	lts
Professional				
Competence				
Knowledge	 Students are able to find their way through selected special areas within civil and structural engineering. Students are able to explain basic models and procedures in selected special areas of civil and structural engineering. Students are able to interrelate scientific and technical knowledge. 			
Skills	 Students are able to apply basi engineering. 	c methods in selected area	s of civil	and structura
Personal				
Competence				
Social Competence				
Autonomy	 Students can chose independe knowledge and skills through the 	-	want to	deepen the
Workload in Hours	Depends on choice of courses			
Credit points	6			
_	Civil Engineering: Specialisation Structur Civil Engineering: Specialisation Geotech Civil Engineering: Specialisation Coastal	nnical Engineering: Elective (Engineering: Elective Comp	Compulso	ry

Civil Engineering: Specialisation Water and Traffic: Elective Compulsory



Course L1867: Analysi	is of Offshore Structures
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	
Examination duration and scale	30 min
Lecturer	Dr. Said Fawad Mohammadi
Language	DE/EN
Cycle	SoSe
Content	Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques
Literature	
Literature	

Course L1840: Design of Concrete Strucutures		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
	Mündliche Prüfung	
Examination duration and scale	20 min	
Lecturer	Dr. Karl Morgen	
Language	DE	
Cycle	WiSe	
Content		
Literature	Schlaich/Schäfer, Konstruieren im Stahlbau, BetonKalender 2001, Tll, Verlag Ernst & Sohn	



Course L0596: Design	of Prefabricated Concrete Structures
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 application and advantages and disadvantages of precast concrete structures basics of design - precast element production - construction - tolerances elements of a warehouse design of a beam - joints design of D-regions: half joints, corbels, openings slab types - walls - facades footings: pocket and block foundations joints - connections shear design of the interface between concrete cast at different times unreinforced concrete structures
Literature	 Bachmann H., Steinle A.; Hahn V.: Bauen mit Betonfertigteilen. Betonkalender 2009, Teil I, Verlag Ernst & Sohn, Berlin Bindseil P.: Stahlbetonfertigteile. Werner Verlag, 1998 FIP: FIP Handbuch für Planung und Entwerfen von Fertigteilbauten (siehe Zeitschrift: Beton- und Fertigteiltechnik ab 3/1996) Bergmeister K.: Konstruieren von Fertigteilen. Betonkalender 2005 Teil 2, S. 163-240 Reineck KH.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 Teil 2, S. 241-296 Graubner CA. et. al.: Bemessung von Fertigteilen nach DIN 1045-1. Betonkalender 2005 Teil 2, S. 297-374 Broschüren der Fachvereinigung Deutscher Betonfertigteilbau e.V. siehe: www.fdb-fertigteilbau.de www.systembauweise.de

Course L0597: Design of Prefabricated Concrete Structures		
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 scale	Siehe korrespondierende Vorlesung	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1634: Forum	I - Geotechnics and Construction Management
Тур	Seminar
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	
Examination duration and scale	30 min
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	Lectures about projects and issues with practical and scientific relevance.
Literature	

Course L1635: Forum II - Geotechnics and Construction Management		
Тур	Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Examination Form		
Examination duration and scale	30 min	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	SoSe	
Content	Lectures about projects and issues with practical and scientific relevance.	
Literature	-	

Course L1151: Timber Structures	
Тур	Seminar
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	
Examination duration and scale	90 min
Lecturer	Prof. Torsten Faber
Language	DE
Cycle	WiSe
Content	
Literature	



Course L1152: Glass Structures		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form	Klausur	
Examination duration and scale	60 min	
Lecturer	Marvin Matzik	
Language	DE	
Cycle	WiSe	
Content	Glass structures - Introduction of the material glass (production, refinement, material characteristic) - design of facades - facade types - static calculation of glazing - static calculation of facades - load bearing behavior of glazing (plate or membrane stiffness) - vertical / horizontal glazing with safety-related requirements - glass structures - fire safety of glass facades - construction physics of facades and glazing	
Literature		
2.13.414.0		

Course L1447: Glass Structures	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	
Examination duration and scale	60 min
Lecturer	Marvin Matzik
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L1905: Wind turbine design	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
	Mündliche Prüfung
Examination duration and scale	30 min
Lecturer	Dr. Jörn Scheller
Language	DE
Cycle	SoSe
Content	
Literature	



Module M0966: S	Study Work Foundation Engineering			
Courses				
Courses Title	Typ Hrs/wk CP			
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	Subjects of the Foundation Engineering specialisation.			
Educational Objectives	Latter taking part successium, students have reached the following learning results			
Professional Competence				
	The students are able to demonstrate their detailed knowledge in the field of geotechnical and foundation engineering. They can exemplify the state of technology and application and discuss critically in the context of actual problems and general conditions of science and society.			
Knowledge	The students can develop solving strategies and approaches for fundamental and practical problems in geotechnical and foundation engineering. They may apply theory based procedures and integrate safety-related, ecological, ethical, and economic view points of science and society.			
	Scientific work techniques that are used can be described and critically reviewed.			
Skills	The students are able to independently select methods for the project work and to justify thi choice. They can explain how these methods relate to the field of work and how the context of application has to be adjusted. General findings and further developments may essentially boutlined.			
Personal				
Competence				
Social Competence	The students are able to condense the relevance and the structure of the project work, the work steps and the sub-problems for the presentation and discussion in front of a bigge group. They can lead the discussion and give a feedback on the project to their colleagues.			
Autonomy	The students are capable of independently planning and documenting the work steps and procedures while considering the given deadlines. This includes the ability to accurately procure the newest scientific information. Furthermore, they can obtain feedback from experts with regard to the progress of the work, and to accomplish results on the state of the art in science and technology.			
Workload in Hours	Independent Study Time 180, Study Time in Lecture 0			
Credit points	6			
Studienleistung	None			
Examination	Study work			
Examination duration and scale	ISEE ESP()			
Assignment for the Following Curricula	II IVII Engingering, Specialication (200technical Engineering, Compilicoty			



Madula M0007: S	tructural Analysis - Selecte	od Tonios		
wodule wossi. S	di uctural Allalysis - Selecte	tu Topics		
Courses				
Title		Тур	Hrs/wk	СР
Plates and Shells (L1199)		Lecture	2	2
Nonlinear Analysis of Fram		Lecture	2	2
Nonlinear Analysis of Fran	· · · · · · · · · · · · · · · · · · ·	Recitation Section (large)	2	2
Module Responsible	Prof. Uwe Starossek			
Admission Requirements	None			
Recommended Previous Knowledge	Mechanics I/II, Mathematics I/II, Differ	ential Equations I		
Educational Objectives	After taking part successfully, student	ts have reached the following lea	rning resu	Its
Professional				
Competence				
Knowledge	After successful completion of this m structural analysis.	nodule, students can explain sel	ected elem	ents of high
Skills	After successful completion of this method the applicability of the presented methods for performing str	ethods of advanced structural ar		
Personal				
Competence				
	Students can			
Social Competence	defend their own work resultspromote the scientific develop			
Autonomy	The students have the opportunity to	voluntarily and independently w	ork homew	ork problem
Workload in Hours	Independent Study Time 96, Study T	ime in Lecture 84		
Credit points	6			
Studienleistung				
Examination	Written exam			
Examination duration and scale	135 min			
Assignment for the Following Curricula	Civil Engineering: Specialisation Stru Civil Engineering: Specialisation Geo Civil Engineering: Specialisation Coa	otechnical Engineering: Elective	Compulso	ry



Course L1199: Plates	and Shells		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Jürgen Priebe		
Language	DE		
Cycle	WiSe		
Content	Theory of plates loaded in-plane Governing equations (equilibrium, kinematics, constitutive law) Differential equation Airy stress function Plane stress / plane strain Structural behaviour of plates loaded in-plane Theory of plates in bending Governing equations (equilibrium, kinematics, constitutive law) Differential equation Navier solution / Fourier series expansion Approximation procedures Structural behaviour of plates in bending Shell theory Phenomenona of the structural behaviour of shells Membrane and bending theory Equilibrium equations of shells of revolution Stress resultants and deformations of the spherical shell, the half spherical shell, and the cylindrical shell Stability problems (overview) Plate buckling Shell buckling		
Literature	 Basar, Y.: Krätzig, W.B. (1985): Mechanik der Flächentragwerke. Vieweg-Verlag Braunschweig, Wiesbaden Girkmann, K. (1963): Flächentragwerke, Springer Verlag, Wien, 1963, unveränderte Nachdruck 1986 Zienkiewicz, O.C. (1977): The Finite Element Method in Enginieering Science McGraw-Hill, London 		



Course L1200: Nonline	Course L1200: Nonlinear Analysis of Frame Structure				
Тур	Lecture				
Hrs/wk	2				
СР	2				
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28				
Lecturer	Prof. Uwe Starossek				
Language	DE				
Cycle	WiSe				
Content	-Types of nonlinearity -relevance of nonlinear effects on structural analysis -comparison and classification of 1st order theory, 2nd order theory and 3rd order theory with regard to the coverage of geometric nonlinearity -fundamentals of 2nd order elasticity theory for frame structures -application of 2nd order elasticity theory using finite elements: common displacement method fundamentals of analytical application of 2nd order elasticity theory: derivation and solution of differential equation -structurally applied methods of analytical application of 2nd order elasticity theory: common displacement method using analytical stiffness matrix, slope-deflection method for sway and non-sway frame structures, consideration of imperfections 1st order plastic hinge theory Rothert H: Gensichen V (1987): Nichtlineare Stabstatik, Springer Verlag, Berlin				
Literature	Rothert, H.; Gensichen, V. (1987): Nichtlineare Stabstatik. Springer Verlag, Berlin				

Course L1201: Nonlinear Analysis of Frame Structure		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Specialization Structural Engineering

Module M0699: A	dvanced	Foundat	ion Engir	neering	and Soil Labor	atory Co	ourse
Courses							
Title					Гур	Hrs/wk	СР
Soil Laboratory Course (L	•				Practical Course	1	2
Advanced Foundation Eng	• •	*			_ecture	2	2
Advanced Foundation En					Recitation Section (large) 1	2
Module Responsible		Grabe					
Admission Requirements	None						
Recommended Previous Knowledge							
Educational Objectives	After taking	part success	fully, students	s have rea	ached the following le	arning resu	Its
Professional Competence							
Knowledge							
Skills							
Personal Competence							
Social Competence							
Autonomy							
Workload in Hours	Independen	t Study Time	124, Study T	ime in Le	cture 56		
Credit points	6	·	-				
	Compulsor	y Bonus	Form		Descripti	on	
Studienleistung	Yes	None	Subject practical w	theoreti ork	cal and		
Examination	Written exan	n					
Examination duration and scale	60 min						
Assignment for the Following Curricula	Civil Engine Civil Engine Civil Engine	ering: Specia ering: Specia ering: Specia I Managema	alisation Geo alisation Coa alisation Wat	technical stal Engir er and Tra	gineering: Compulsor Engineering: Compul neering: Compulsory affic: Elective Compuls Specialisation II. Ci	sory	ering: Elective



Course L0499: Soil Laboratory Course		
Тур	Practical Course	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
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 L0497: Advance	Course L0497: Advanced Foundation Engineering			
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	WiSe			
Content	 Vertical drains Piles Ground improvement (Deep Compaction, Soil mixing) Vibration driving Jet grouting Slurry wall Deep excavation 			
Literature	 EAK (2002): Empfehlungen für Küstenschutzbauwerke EAU (2004): Empfehlungen des Arbeitsausschusses Uferbauwerke EAB (1988): Empfehlungen des Arbeitskreises Baugruben Grundbau-Taschenbuch, Teil 1-3, (1997), Ernst & Sohn Verlag 			



Course L0498: Advanced Foundation Engineering	
Тур	Recitation Section (large)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0713: C	Concrete Structures			
Courses				
Title		Тур	Hrs/wk	СР
Concrete Structures (L05		Seminar	1	1
Structural Concrete Memi		Lecture	2	3
Structural Concrete Meml	pers (L05/8)	Recitation Section (large) 2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
Decemberded	Basics of structural analysis, concep	tion and dimensioning of structu	ral concrete	
Recommended Previous Knowledge	Modules 'Concrete Structures I and	II'		
Educational Objectives	I After taking part currectilly, ctudente have reached the following learning reculte			
Professional				
Competence				
Knowledge	The students broaden their skills in structural engineering, especially in the field of buildings (houses, roofs, halls). They dispose of the knowledge for the conception and design of concrete buildings and structural members that are often used.			
Skills	The students are able to apply procedures of the conception and dimensioning to to practical problems of structural engineering. They are capable to draft concrete buildings and to design them for general action effects and to plan their detailing and execution. Moreover, they can make design and construction sketches and draw up technical descriptions.			
Personal Competence				
Social Competence	The students are able to obtain resu	Its of high quality in teamwork.		
Autonomy	The students are able to carry out complex conception and dimensioning tasks of structures under the guidance of tutors.			
Workload in Hours	Independent Study Time 110, Study	Time in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	120 minutes			
	Civil Engineering: Specialisation Str Civil Engineering: Specialisation Ge Civil Engineering: Specialisation Co Civil Engineering: Specialisation Wa International Management and Er	eotechnical Engineering: Elective pastal Engineering: Elective Com ater and Traffic: Elective Compuls	Compulsor pulsory sory	

Compulsory



Course L0579: Concrete Structures	
Тур	Seminar
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	With help of a project teamwork the subjects of the course "Concrete Structures" is practiced, discussed and presented.
Literature	- Projektbezogene Unterlagen werden abgegeben.

Course L0577: Structural Concrete Members		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	 concrete buildings actions on structrues bracing systems slabs (line and point supported plates and floor slabs) membranes and deep beams shells and folded plates reinforced and prestressed members 	
Literature	- Vorlesungsunterlagen	

Course L0578: Structural Concrete Members	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0963: S	teel and Composite Structures			
Courses				
		Тур	Hrs/wk	СР
Steel and Composite Struc	ctures (L1204)	Lecture	2	2
Steel and Composite Struc		Recitation Section (large)	2	2
Steel Bridges (L1097)		Lecture	2	2
Module Responsible	Prof. Marcus Rutner			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of steel construction (i.e. Steel Struc	ctures I and II, BUBC)		
Educational Objectives	After taking part successfully, students have	re reached the following lea	rning results	3
Professional Competence				
	After successful completition, students can			
Knowledge	 describe the phenomenon of local buckling explain warping torsion illustrate the behaviour of composite structures specify the principles in design of composite structures sketch the contructions of steel and composite bridges 			
Skills	After successful participation students are able to check stiffened and unstiffened plated structures recognize and verify warping tosion in strucures design composite structures edesign bridges and o perform the detailing			
Personal				
Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in	Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the	Civil Engineering: Specialisation Structural Civil Engineering: Specialisation Geotechic Civil Engineering: Specialisation Coastal I Civil Engineering: Specialisation Water and International Management and Enginee Compulsory	nical Engineering: Elective Engineering: Elective Comp d Traffic: Elective Compulso	Compulsory oulsory ory	



Course L1204: Steel and Composite Structures		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Marcus Rutner	
Language	DE	
Cycle	WiSe	
Content	 Local-buckling of plated structures Warping torsion Composite-girders, -columns, -slabs, -bridges Principles in composite constructions Bridge-design and -construction 	
Literature	Petersen, C.: Stahlbau, 4.Auflage 2013, Springer-Vieweg Verlag Minnert, J. Wagenknecht, G.: Verbundbau-Praxis - Berechnung und Konstruktion nach Eurocode 4, 2.Auflage 2013, Bauwerk Beuth Verlag	

Course L1205: Steel and Composite Structures	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



urse L1097: Steel B	ridges
Тур	Lecture
Hrs/wk	2
СР	2
	Independent Study Time 32, Study Time in Lecture 28
	Dr. Jörg Ahlgrimm
Language	WiSe
Сусте	Lecture Contents ,Steel Bridge Construction' DrIng. Jörg Ahlgrimm
	- From tendering and contracting to completion - the development of a steel bridge
	- Contents of a bridge static - structural details, examples of analysis in detail:
	-> effective width in regard to the longitudinal stiffeners
	-> Bearing point, bearing stiffener
	-> Crossbeam breakthrough, crossbeam reinforcement
	-> Analysis of the Rib-to-Floorbeam (RF) connection (web-tooth of the floorbeam between trapezoidal shaped Ribs)
Content	- Steel grades, -designation, testing methods and approval certificates
	- Nondestructive weld inspecting
	- Corrosion protection
	- Bridge bearing - types, format, function, dimensioning, installation
	- Expansion Joints
	- Oscillation of bridge hangers and cables - oscillation damper
	- Opening bridges- Detailed reviews to different assembling procedures and - implements
	- Selective damage events
	Requirements: Basic knowledge in the calculation, dimensioning, and construction structural elements and joints of constructional steelwork
	Herbert Schmidt, Ulrich Schulte, Rainer Zwätz, Lothar Bär: Ausführung von Stahlbauten
Literature	 Petersen, Christian: Stahlbau, Abschnitt Brückenbau Ahlgrimm, J., Lohrer, I.: Erneuerung der Eisenbahnüberführung in Fulda-Horas üt
	die Fulda, Stahlbau 74 (2005), Heft 2, S. 114



Module M0511: E	Electricity Generation from	Wind and Hydro Pow	ver	
Courses				
Title		Тур	Hrs/wk	СР
	ets in Emerged Markets (L0014)	Project Seminar	1	1
Hydro Power Use (L0013		Lecture	1	1
Wind Turbine Plants (L00	•	Lecture	2	3
Wind Energy Use - Focus	· · · · · · · · · · · · · · · · · · ·	Lecture	1	1
Module Responsible Admission				
Requirements	None			
	Module: Technical Thermodynamics	l,		
	Module: Technical Thermodynamics	II,		
Previous Knowledge	Module: Fundamentals of Fluid Mech	nanics		
Educational	After telding and account of the student	4. h		11.
Objectives	After taking part successfully, studen	is nave reached the following	g learning resu	ITS
Professional Competence				
By ending this module students can explain in detail knowledge of wind turbing particular focus of wind energy use in offshore conditions and can critical comma aspects in consideration of current developments. Furthermore, they are describe fundamentally the use of water power to generate electricity. The students rand explain the basic procedure in the implementation of renewable energy procedures outside Europe.		omment thes are able tents reproduc		
	Through active discussions of vari improve their understanding and the able to transfer what they have learn	e application of the theoretic		
Skills	Students are able to apply the acquired theoretical foundations on exemplary water or wind power systems and evaluate and assess technically the resulting relationships in the context of dimensioning and operation of these energy systems. They can in compare critically the special procedure for the implementation of renewable energy projects in countries outside Europe with the in principle applied approach in Europe and can apply this procedure on exemplary theoretical projects.			
Personal				
Competence Social Competence	Students can discuss scientific tasks	subjet-specificly and multid	isciplinary withi	in a seminar.
Autonomy	Students can independently exploit sources in the context of the emphasis of the lecture material to clear the contents of the lecture and to acquire the particular knowledge about the subject area.			
Workload in Hours	Independent Study Time 110, Study	Time in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	3 hours written exam			
	Civil Engineering: Specialisation Stru Civil Engineering: Specialisation Ge			ry

Compulsory



Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Energy Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Renewable Energy: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Product Development, Materials and Production: Specialisation Product Development: Assignment for the Elective Compulsory **Following Curricula** Product Development, Materials and Production: Specialisation Production: Elective Compulsory Product Development, Materials and Production: Specialisation Materials: Elective Compulsory Renewable Energies: Core qualification: Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory Theoretical Mechanical Engineering: Specialisation Energy Systems: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective

Water and Environmental Engineering: Specialisation Environment: Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory



Course L0014: Renew	able Energy Projects in Emerged Markets
Тур	Project Seminar
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Andreas Wiese
Language	DE
Cycle	SoSe
Literature	1. Introduction



Course L0013: Hydro Power Use		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Stephan Heimerl	
Language	DE	
Cycle	SoSe	
Content	 Introduction, importance of water power in the national and global context Physical basics: Bernoulli's equation, usable height of fall, hydrological measures, loss mechanisms, efficiencies Classification of Hydropower: Flow and Storage hydropower, low and high pressure systems Construction of hydroelectric power plants: description of the individual components and their technical system interaction Structural engineering components; representation of dams, weirs, dams, power houses, computer systems, etc. Energy Technical Components: Illustration of the different types of hydraulic machinery, generators and grid connection Hydropower and the Environment Examples from practice 	
Literature	 Schröder, W.; Euler, G.; Schneider, K.: Grundlagen des Wasserbaus; Werner, Düsseldorf, 1999, 4. Auflage Quaschning, V.: Regenerative Energiesysteme: Technologie - Berechnung - Simulation; Carl Hanser, München, 2011, 7. Auflage Giesecke, J.; Heimerl, S.; Mosony, E.: Wasserkraftanlagen Planung, Bau und Betrieb; Springer, Berlin, Heidelberg, 2009, 5. Auflage von König, F.; Jehle, C.: Bau von Wasserkraftanlagen - Praxisbezogene Planungsunterlagen; C. F. Müller, Heidelberg, 2005, 4. Auflage Strobl, T.; Zunic, F.: Wasserbau: Aktuelle Grundlagen - Neue Entwicklungen; Springer, Berlin, Heidelberg, 2006 	



Course L0011: Wind Turbine Plants	
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Rudolf Zellermann
Language	DE
Cycle	SoSe
Content	 Historical development Wind: origins, geographic and temporal distribution, locations Power coefficient, rotor thrust Aerodynamics of the rotor Operating performance Power limitation, partial load, pitch and stall control Plant selection, yield prediction, economy Excursion
Literature	Gasch, R., Windkraftanlagen, 4. Auflage, Teubner-Verlag, 2005





Module M1351: C	onstruction Process	ses		
Courses				
Title		Тур	Hrs	/wk CP
Digital Building (L1908)		Lecture	2	2
ean Construction (L1910)		Lecture	2	2
System Dynamics (L1909))	Lecture	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional				
Competence				
Knowledge				
Skills				
Personal				
Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96	5, Study Time in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	60 min			
Assignment for the Following Curricula	Civil Engineering: Specialis Civil Engineering: Specialis	cation Coastal Engineering: cation Geotechnical Enginee cation Structural Engineering cation Water and Traffic: Elec	ering: Elective Compuls	pulsory

Course L1908: Digital Building		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Katja Maaser	
Language	DE	
Cycle	SoSe	
Content		
Literature		



Course L1910: Lean Construction		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Theo Herzog	
Language	DE	
Cycle	SoSe	
Content		
Literature		

Course L1909: System	Course L1909: System Dynamics		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Nicole Mörchen, Dr. Markus Salge		
Language	DE		
Cycle	SoSe		
Content			
Literature			



Module M0723: D	esign of Prestressed Structures a	and Concrete Bri	dges	
Courses				
=	ructures and Concreet Bridges (L0603) ructures and Concreet Bridges (L0604)	Typ Lecture Recitation Section (large)	Hrs/wk 3 2	CP 4 2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
Recommended Previous Knowledge	Detailed knowledge on the design of concrete	structures.		
Educational Objectives	After taking part successfully, students have re	ached the following lea	rning results	6
Professional Competence				
Knowledge	The students know the main bridge types, their applications and the various loads. They can explain the basic design methods. They can explain the design of a prestressed bridge.			
Skills	The students are able to design reinforced or prestressed concrete bridges.			
Personal Competence				
Social Competence	The students can design in teamwork a real concrete bridge.			
Autonomy	The students are able to design a prestressed concrete bridge and discuss the problems and results with other students.			
Workload in Hours	Independent Study Time 110, Study Time in Le	ecture 70		
Credit points				
Studienleistung				-
	Written exam			
Examination duration and scale	180 minutes			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural En Civil Engineering: Specialisation Geotechnica Civil Engineering: Specialisation Coastal Engi International Management and Engineering Compulsory	I Engineering: Elective neering: Elective Comp	Compulsory oulsory	



Typ Lecture Hrs/wk 3 CP 4 Workload in Hours Independent Study Time 78, Study Time in Lecture 42 Lecturer Prof. Günter Rombach Language DE Cycle SoSe prestressed structures	ourse L0603: Design	of Prestressed Structures and Concreet Bridges
CP 4	Тур	Lecture
Independent Study Time 78, Study Time in Lecture 42 Lecturer	Hrs/wk	3
Lecturer Language Cycle SoSe prestressed structures • basis of prestressed structures • differences between reinforced and prestressed concrete structures • history of prestressing • construction: prestressing methods • prestressing forces and member forces (friction, elongation) • tendon layout • time dependant prestressing losses • design of prestressed structures • design of anchorage region • non-bonded prestressing Content Concrete bridges • history of bridges • design of bridges • design of bridges • loads on bridges • member forces for slab, T-beam, hollow box, frame and arch bridges • precast bridges - precast segmental bridges	СР	4
Language Cycle SoSe prestressed structures	Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
restressed structures basis of prestressed structures differences between reinforced and prestressed concrete structures history of prestressing construction materials: concrete, tendons, ducts, anchorage systems construction: prestressing methods prestressing forces and member forces (friction, elongation) tendon layout time dependant prestressing losses design of prestressed structures design of anchorage region non-bonded prestressing prestressed flat slabs Concrete bridges history of bridges design of bridges loads on bridges loads on bridges member forces for slab, T-beam, hollow box, frame and arch bridges precast bridges - precast segmental bridges	Lecturer	Prof. Günter Rombach
prestressed structures	Language	DE
basis of prestressed structures differences between reinforced and prestressed concrete structures history of prestressing construction materials: concrete, tendons, ducts, anchorage systems construction: prestressing methods prestressing forces and member forces (friction, elongation) tendon layout time dependant prestressing losses design of prestressed structures design of anchorage region non-bonded prestressing prestressed flat slabs Concrete bridges history of bridges design of bridges loads on bridges loads on bridges member forces for slab, T-beam, hollow box, frame and arch bridges precast bridges - precast segmental bridges	Cycle	SoSe
		 basis of prestressed structures differences between reinforced and prestressed concrete structures history of prestressing construction materials: concrete, tendons, ducts, anchorage systems construction: prestressing methods prestressing forces and member forces (friction, elongation) tendon layout time dependant prestressing losses design of prestressed structures design of anchorage region non-bonded prestressing prestressed flat slabs Concrete bridges history of bridges design of bridges loads on bridges member forces for slab, T-beam, hollow box, frame and arch bridges
	Literature	 Rombach, G. (2003): Spannbetonbau. Ernst & Sohn, Berlin Wicke, M. (2002): Anwendung des Spannbetons. Betonkalender 2002, Teil II, S. 113 180, Verlag Ernst & Sohn, Berlin Leonhardt, F. (1980): Vorlesungen über Massivbau. Teil 5: Spannbeton. Berlin Mehlhorn, G. (2007): Handbuch Brücken, Springer Verlag Schäfer, H.; Kaufeld, K. (1997): Massivbrücken. Betonkalender Teil II, S. 443ff, Ernst Sohn, Berlin Menn, Ch. (1986): Stahlbetonbrücken. Springer Verlag, Wien



Course L0604: Design of Prestressed Structures and Concreet Bridges		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0756: S	Soil Mechanics and	-Dynamics			
module moreo. e		Dynamios			
Courses					
Title			Гур	Hrs/wk	СР
Soil Mechanics - Selected	d Topics (L0374)		_ecture	2	2
Soil Dynamics (L0452) Lecture 3 2			2		
Experimental Researches	s in Geotechnics (L0706)	F	Practical Course	1	2
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	INONE				
Recommended	modules: Mathematics I-I	II, Mechanics I-II, Geot	echnics I		
	courses: Soil laboratory o	course, (Applied structu	ıral dynamics)		
	<u> </u>				
Educational Objectives	After taking part successf	ully, students have rea	ched the following	learning resu	Its
Professional					
Competence	After the successful comp	plation of the module th	a etudente ehould	he able to:	
	1	pply the basic equation			
	 to understand the wave propagation in the soil under dynamic excitation and to detect the relevant parameters, 				
	 to know the essential laboratory and field tests to determine soil dynamic 				
	characteristics and to evaluate them,				
	 to design machine foundations to dynamic load, to measure shocks to perform vibration forecast, 				
		s in term to their effect		dinas.	
		pilities of isolation,		,g.,	
		 to understand mechanisms that cause earthquakes and evaluate earthquake in te 			uake in term o
Knowledge	_	· · · · · · · · · · · · · · · · · · ·	e canacity integrit	v and the dyn	amic hedding
	 to know methods to determine axial pile capacity, integrity and the dynamic bedding modulus, 				
	 to know the mechanisms that lead to a deformation accumulation due to cyclic loading 				
	 and to estimate these deformations mathematically, to distinguish the area of application of the method of elastodynamics and 				
	plastodynamics,	ie area oi appiicati	on of the metho	d of elasion	iynamics and
	 to detect the undrained shear strength as a function of a number of state variables, to capture the viscus behaviour of cohesive soils and to consider the effects of creen 				
	 to capture the visous behaviour of cohesive soils and to consider the effects and rate-dependent shear strength in calculations, 			ffects of creep	
	•	pact of the partly satur		and shear stre	ength.
					
Skills	<u> </u>				
Personal Competence					
Social Competence					
Autonomy					
	Independent Study Time	96, Study Time in Lect	ure 84		
Credit points	<u></u>	•			
	Compulsory Bonus	Form	Descri	ption	
Studienleistung		Subject theoretic			
	165 10 %	practical work			
Examination	Oral exam				
	1				



Examination duration and scale	
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Course L0374: Soil Me	Course L0374: Soil Mechanics - Selected Topics		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Hans Mathäus Stanford		
Language	DE		
Cycle	SoSe		
Content	selected topis: - continuum mechanis - constitutive modelling - time and rate dependend material behavior of soils - cyclic loading - undrained conditions		
Literature	Kolymbas D. (2007): Geotechnik - Bodenmechanik, Grundbau und Tunnelbau. Springer Verlag		



Course L0452: Soil Dy	namics
Тур	Lecture
Hrs/wk	3
СР	2
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42
Lecturer	Dr. Sascha Henke
Language	DE
Cycle	SoSe
	mass-spring-damper systems,
	• wave propagation in soils,
Content	dynamic soil parameters,
	Determination of dynamic soil parameters,
	machine foundations,
	• in-situ measurement of ground motion, ground motion prediction, evaluation of ground motion,
	• ground motion shielding,
	• introduction into earthquake engineering,
	dynamic pile tests,
	cyclic accumulation,
	• plastodynamics
Literature	 Das B.M.: Fundamentals of Soil Dynamics, Elsevier Empfehlungen des Arbeitskreises Baugrunddynamik. Hrsg. Deutsche Gesellschaft für Geotechnik (DGGT) Haupt W.: Bodendynamik. Vieweg und Teubner Meskouris K. und Hinzen KG.: Bauwerke und Erdbeben. Vieweg Verlag Studer J.A., Koller M.G. und Laue J.: Bodendynamik, Springer Verlag



Course L0706: Experi	imental Researches in Geotechnics
Тур	Practical Course
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Marius Milatz
Language	DE
Cycle	SoSe
Content	become acquainted with geotechnical model tests, field tests and laboratory tests as well as corresponding measurement techniques. These compromise amongst others inclinometer measurements and geophone measurements as well as high-grade laboratory tests on the stress-strain relationship of soil specimens, e. g. triaxial tests, simple shear tests and resonant column tests. gain insight into current soil mechanical research. plan, coordinate, perform and evaluate soil mechanical tests in a team. discuss, reflect, review and present the obtained results in a group. An important learning target is the introduction to scientific work for students who plan a scientific career, and for those who will work in practice with the responsibility to order corresponding tests and evaluate the results. The practical laboratory work is based on annualy changing problems, which are however related to the experience and results of the preceding year's course group.
Literature	 Grabe, J. (2004): Bodenmechanik und Grundbau, Band 3 der Veröffentlichungsreihe des Instituts für Geotechnik und Baubetrieb, Technische Universität Hamburg-Harburg. Kolymbas, D. (2007): Geotechnik - Bodenmechanik, Grundbau und Tunnelbau. 2., korrigierte und ergänzte Auflage, Springer Verlag. Normen zu geotechnischen Versuchsgeräten und Versuchsverfahren: DIN 18135:2012-04: Baugrund, Untersuchung von Bodenproben - Eindimensionaler Kompressionsversuch, Deutsches Institut für Normung, e. V. DIN 18137-2:2011-04: Baugrund, Untersuchung von Bodenproben - Bestimmung der Scherfestigkeit - Teil 2: Triaxialversuch, Deutsches Institut für Normung e. V.



Courses					
Title Boundary Element Method Boundary Element Method			Typ Lecture Recitation Section (large)	Hrs/wk 2 2	CP 3 3
Module Responsible			, ,		
Admission Requirements	None				
Recommended Previous Knowledge	Mechanics I (Statics, M Dynamics) Mathematics I, II, III (in pa			lydrostatics	, Kinematic
Educational Objectives	After taking part success	lly, students have re	eached the following lea	rning result	ts
Professional Competence					
Knowledge	The students possess an in-depth knowledge regarding the derivation of the boundary element method and are able to give an overview of the theoretical and methodical basis of the method.				
Skills	The students are capable elements, assembling the equations.	-	- ·	-	
Personal Competence	Students can work in sm	L groupe on openific	problems to errive et ini	nt colutions	
Social Competence	The students are able develop own boundary critically scrutinized.	o independently se	olve challenging comp	utational p	roblems ar
Autonomy	,				
Workload in Hours	Independent Study Time	24, Study Time in L	ecture 56		
Credit points	6				
Studienleistung	Compulsory Bonus No 20 %	Form Midterm	Descriptio	n	
Examination	Written exam				
Examination duration and scale	90 min				
	Civil Engineering: Special Civil Engineering: Special Civil Engineering: Special Energy Systems: Core quality of the core of t	isation Geotechnica isation Coastal Eng	al Engineering: Elective (ineering: Elective Comp	Compulsor	y



	Computational Science and Engineering: Specialisation Scientific Computing: Elective Compulsory
Assignment for the	Mechanical Engineering and Management: Specialisation Product Development and
Following Curricula	Production: Elective Compulsory
	Mechatronics: Specialisation System Design: Elective Compulsory
	Product Development, Materials and Production: Core qualification: Elective Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory
	Technomathematics: Core qualification: Elective Compulsory
	Theoretical Mechanical Engineering: Core qualification: Elective Compulsory
	Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0523: Bounda	ary Element Methods
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Otto von Estorff
Language	EN
Cycle	SoSe
Content	- Boundary value problems - Integral equations - Fundamental Solutions - Element formulations - Numerical integration - Solving systems of equations (statics, dynamics) - Special BEM formulations - Coupling of FEM and BEM - Hands-on Sessions (programming of BE routines) - Applications
Literature	Gaul, L.; Fiedler, Ch. (1997): Methode der Randelemente in Statik und Dynamik. Vieweg, Braunschweig, Wiesbaden Bathe, KJ. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin

Course L0524: Boundary Element Methods	
Тур	Recitation Section (large)
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Otto von Estorff
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Applied Groundwater Modeling (L0543) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Modeling of Water Supply and Sewer Network (L0875) Modeling of Water Supply and Sewer Network (L0875) Modeling of Water Supply and Sewer Network (L0875) None Requirements Groundwater • groundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge • Knowledge on urban water infrastructures, in particular drinking water systemsau urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems • Basic knowledge on water management Educational Objectives Professional Competence Knowledge The students are able to describe the modelling of groundwater flow and transport as well urban water infrastructures. They can carry out systems analyses and can detect technical are conceptual weak points within the systems in case studies. Besides they are able to analy interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent They can work on different scenarios and can compare or assess different solutions to existing problems by application of selected software products. The students are able to use of the students are able to us	Module M0827: N	Modeling in Water Management			
Applied Groundwater Modeling (L0543) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Applied Groundwater Modeling (L0544) Modeling of Water Supply and Sewer Network (L0875) Modeling of Water Supply and Sewer Network (L0875) Modeling of Water Supply and Sewer Network (L0875) None Requirements Groundwater • groundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge • Knowledge on urban water infrastructures, in particular drinking water systemsau urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems • Basic knowledge on water management Educational Objectives Professional Competence Knowledge The students are able to describe the modelling of groundwater flow and transport as well urban water infrastructures. They can carry out systems analyses and can detect technical are conceptual weak points within the systems in case studies. Besides they are able to analy interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent They can work on different scenarios and can compare or assess different solutions to existing problems by application of selected software products. The students are able to use of the students are able to us	Courses				
Module Responsible NN	Title Typ Hrs/wk CP Applied Groundwater Modeling (L0543) Lecture 1 1 1 Applied Groundwater Modeling (L0544) Recitation Section (small) 2 2 Project /problem-based			1 2	
Recommended Previous Knowledge Previous Knowledge **Nowledge on urban water infrastructures, in particular drinking water systemsal urban drainage systems including special structures **Hydraulics of drinking water supply systems and sewer systems **Basic knowledge on water management **After taking part successfully, students have reached the following learning results Professional Competence **The students are able to describe the modelling of groundwater flow and transport as well urban water infrastructures. They can carry out systems analyses and can detect technical at conceptual weak points within the systems in case studies. Besides they are able to analytic interdependencies of hydraulic and toxic phenomena in soil and water. **The students are able to construct and apply scientific groundwater models indipendent They can work on different scenarios and can compare or assess different software solutions (e.g. EPANET, EPA-SWMM). **Personal Competence Autonomy** Workload in Hours Independent Study Time 110, Study Time in Lecture 70 **Credit points** **Studienleistung** **Mone** **Lauding** **Laudi	Madula Dagnanaikla	NINI	Learning		
Previous Knowledge Protessional Competence Protessional Competence The students are able to describe the modelling of groundwater flow and transport as well urban water infrastructures. They can carry out systems analyses and can detect technical as conceptual weak points within the systems in case studies. Besides they are able to analysinterdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent They can work on different scenarios and can compare or assess different solutions is existing problems by application of selected software products. The students are able to us different software solutions (e.g. EPANET, EPA-SWMM). Personal Competence Social Competence Social Competence Virid nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Studienleistung None Examination Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Admission				
Professional Competence Knowledge The students are able to describe the modelling of groundwater flow and transport as well urban water infrastructures. They can carry out systems analyses and can detect technical arconceptual weak points within the systems in case studies. Besides they are able to analysi interdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent They can work on different scenarios and can compare or assess different solutions to existing problems by application of selected software products. The students are able to use different software solutions (e.g. EPANET, EPA-SWMM). Personal Competence Social Competence Autonomy Wird nicht vermittelt. Wird nicht vermittelt. Wird nicht vermittelt. Wird nicht vermittelt. Studienleistung None Examination duration and scale Civil Engineering: Specialisation Structural Engineering: Elective Compulsory		 groundwater hydraulics and transport Pipe Systems Knowledge on urban water infrastructurban drainage systems including spe Hydraulics of drinking water supply systems 	ctures, in particular drir cial structures stems and sewer system	-	r systemsand
The students are able to describe the modelling of groundwater flow and transport as well urban water infrastructures. They can carry out systems analyses and can detect technical are conceptual weak points within the systems in case studies. Besides they are able to analysinterdependencies of hydraulic and toxic phenomena in soil and water. The students are able to construct and apply scientific groundwater models indipendent They can work on different scenarios and can compare or assess different solutions as existing problems by application of selected software products. The students are able to use different software solutions (e.g. EPANET, EPA-SWMM). Personal Competence Social Competence Wird nicht vermittelt. Wird nicht vermittelt. Wird nicht vermittelt. Oral exam Examination duration and scale Civil Engineering: Specialisation Structural Engineering: Elective Compulsory		After taking part successfully, students have re	eached the following lea	rning resul	ts
They can work on different scenarios and can compare or assess different solutions of existing problems by application of selected software products. The students are able to use different software solutions (e.g. EPANET, EPA-SWMM). Personal Competence Social Competence Autonomy Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points 6 Studienleistung None Examination Oral exam Examination duration and scale Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Competence	The students are able to describe the modelling of groundwater flow and transport as well as urban water infrastructures. They can carry out systems analyses and can detect technical and conceptual weak points within the systems in case studies. Besides they are able to analyse			
Competence Wird nicht vermittelt. Autonomy Wird nicht vermittelt. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points 6 Studienleistung None Examination Oral exam Examination duration and scale 20 min Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Skills	The students are able to construct and apply scientific groundwater models indipendently They can work on different scenarios and can compare or assess different solutions for existing problems by application of selected software products. The students are able to use different software solutions (e.g. EPANET, EPA-SWMM).			
Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points 6 Studienleistung None Examination Oral exam Examination duration and scale Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Competence	! ! Wind a labt warm: that			
Credit points 6 Studienleistung None Examination Oral exam Examination duration and scale Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	·				
Studienleistung Examination Oral exam Examination duration and scale Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Workload in Hours	Independent Study Time 110, Study Time in L	ecture 70		
Examination Oral exam Examination duration and scale 20 min Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Credit points	6			
Examination duration and scale 20 min Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Studienleistung	None			
and scale Civil Engineering: Specialisation Structural Engineering: Elective Compulsory	Examination	Oral exam			
		20 min			
Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory		· · · · · · · · · · · · · · · · · · ·	-		y



Assignment for the Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Following Curricula Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory

> Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0543: Applied	Course L0543: Applied Groundwater Modeling		
Тур	Lecture		
Hrs/wk	1		
СР	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Sonja Schröter		
Language	DE/EN		
Cycle	SoSe		
	Introduction and application of the groundwater model MODFLOW (PMWIN); theoretical backround of the modell, students do work with the model PMWIN for practical case studies.		
	MODFLOW-Handbuch Chiang, Wen Hsien: PMWIN		

Course L0544: Applied	Course L0544: Applied Groundwater Modeling	
Тур	Recitation Section (small)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Sonja Schröter	
Language	DE/EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0875: Modeling of Water Supply and Sewer Network	
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen, Weitere Mitarbeiter
Language	DE
Cycle	SoSe
Content	
Literature	Mutschmann/Stimmelmayr: Taschenbuch der Wasserversorgung, 16. Auflage. Springer Vieweg - Verlag. Wiesbaden 2014.



Courses				
Title Noise Protection (L1109)		Typ Lecture	Hrs/wk	CP 2
Urban Infrastructures (L0	874)	Project-/problem-based Learning	2	4
Module Responsible	Dr. Dorothea Rechtenbach			
Admission Requirements	None			
Recommended Previous Knowledge	 Knowledge on Urban planning Knowledge on measures for climate General knowledge of scientific writi 	•		
Educational Objectives	After taking part successfully, students have	reached the following lea	ırning resul	ts
Professional Competence				
Knowledge	Students can describe urban development corridors as well as current and future urban environmental problems. They are able to explain the causes of environmental problems (like noise). Students can specify applications for various technical innovations and explain why these contribute to the improvement of urban life. They can, for example, derive and discuss measures for effective noise abatement.			
Skills	Students are able to develop specific solutions for correcting existing or future environment-related problems of urban development. They can define a range of conceptual and technica solutions for environmental problems for different development paths. To solve specific urban environmental problems they can select technical innovations and integrate them into the urban context.			
Personal Competence				
Social Competence	The students can work together in internation	nal groups.		
Autonomy	Students are able to organize their work flow to prepare themselves for presentations and contributions to the discussions. They can acquire appropriate knowledge by making enquiries independently.			
Workload in Hours	Independent Study Time 124, Study Time in	Lecture 56		
Credit points				
Studienleistung				
	Written elaboration			
Examination duration and scale	Written Report plus oral Presentation			
Assignment for the Following Curricula				



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise F	Protection
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Jäschke
Language	EN
Cycle	SoSe
Content	
	 Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) WHO (1999): Guidelines for Community Noise Environmental Noise Directive 2002/49/EG ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation

Course L0874: Urban Infrastructures	
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Dr. Dorothea Rechtenbach
Language	EN
Cycle	SoSe
Content	Problem Based Learning Main topics are: Central vs. Decentral Wastewater Treatment. Compaction of Cities. Car Free Cities. Multifunctional Places in Cities. The Sustainability of Freight Transport in Cities.
Literature	Depends on chosen topic.



Module M0859: C	Coastal Hydraulic Engineering II			
Courses				
Title Coastal- and Flood Protect	etion (L0808)	Typ Lecture	Hrs/wk	CP 3
Coastal- and Flood Protect	ction (L1415)	Project-/problem-based Learning	1	1
Maintennance and Defend	ce of Flood Protection Structures (L1411)	Lecture	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	INONE			
Recommended Previous Knowledge	Coastal Engineering I			
Educational Objectives	After taking part successfully, students have r	reached the following lea	arning resul	lts
Professional Competence				
Knowledge	The students have the capability to define and explain in detail the important aspects of erosion protection and flood protection and are able to apply the aspects to practical coastal protection problems. They are able to design and dimension important coastal protection measures from the functional and from the constructional point of view.			
Skills	The students are able to select design approaches for the functional and constructional design of erosion and flood protection measures and apply these approaches to practical design tasks.			
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as the functional and constructive design of coastal and flood protection structures. Additionaly, they will be able to work in team with engineers of other disciplines.			
Autonomy	The students will be able to independent problems.	y extend their knowled	lge and ap	oply it to new
Workload in Hours	Independent Study Time 110, Study Time in	Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 130 min. I general understanding of the lecture contents			respect to the
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural E Civil Engineering: Specialisation Geotechnic Civil Engineering: Specialisation Coastal Eng	al Engineering: Elective		Т у



Typ Lecture Hrs/wk 2 CP 3 Workload in Hours Independent Study Time 62, Study Time in Lecture 28 Lecturer Prof. Peter Fröhle Language DE Cycle SoSe Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Other Concepst Calculation approaches and numerical models Content Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland Vorlesungsumdruck Coastal Engineering Manual CEM	Course L0808: Coasta	II- and Flood Protection
Workload in Hours Independent Study Time 62, Study Time in Lecture 28 Lecturer Prof. Peter Fröhle Language DE Cycle SoSe Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Calculation approaches and numerical models Content Content Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Flood-Protection Walls Drainage of the hinterland	Тур	Lecture
Workload in Hours Lecturer Prof. Peter Fröhle Language DE Cycle SoSe Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Calculation approaches and numerical models Content Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland Vorlesungsumdruck	Hrs/wk	2
Lecturer Language DE Cycle SoSe Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Other Concepst Calculation approaches and numerical models Content Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland Vorlesungsumdruck	СР	3
Language Cycle SoSe Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Constructions perpendicular to the coast Content Calculation approaches and numerical models Content Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland Vorlesungsumdruck	Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Cycle Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Calculation approaches and numerical models Content Content Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland Vorlesungsumdruck	Lecturer	Prof. Peter Fröhle
Protection of sandy coasts Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Content Calculation approaches and numerical models Content Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls Drainage of the hinterland Vorlesungsumdruck	Language	DE
Sediment transport Morphology Technical solution for the protection of sandy coasts	Cycle	SoSe
Coastel Engineering Manual CEM	Content	 Sediment transport Morphology Technical solution for the protection of sandy coasts Construction in direction of the coast Constructions perpendicular to the coast Other Concepst Calculation approaches and numerical models Flood Protection Classification of constructions / measures Dikes Dunes Foreland - constructions Flood-Protection Walls
	Literature	

Course L1415: Coasta	Course L1415: Coastal- and Flood Protection	
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1411: Maintennance and Defence of Flood Protection Structures	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Olaf Müller
Language	DE
Cycle	SoSe
Content	 Dike protection Maintennance of flood protection measures
Literature	Vorlesungsumdruck



	Typ Lecture Project-/problem-based	Hrs/wk 2	CP 2
2)	Learning	Į.	2
•	Lecture	2	2
nie			
tal engineering			
rt successfully, studen	ts have reached the following le	earning resu	lts
The students are able to define in details and to choose design approaches for the function design of a port and apply them to design tasks. They can design the fundamental elements a port.			
The students are able to select and apply appropriate approaches for the functional design of ports.			
The students are able to deploy their gained knowledge in applied problems such as th functional design of ports. Additionaly, they will be able to work in team with engineers of other disciplines.			
will be able to indep	pendently extend their knowle	dge and a	oply it to ne
tudy Time 110, Study	Time in Lecture 70		
			respect to th
Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory			
	are able to define in derit and apply them to derit and apply them to deare able to select and are able to select and are able to deploy the are able to independ of ports. Additional will be able to independ of the examination is 15 standing of the lecture ing: Specialisation Straing: Specialisation Geometric Specialisation Geometric Specialisation Contains and English and English and English are able to deploy the series and the series are able to deploy the series and the series are able to deploy the series and applications are able to deploy the series are able to independ on the series are able to deploy the series are able	Lecture Project-/problem-based Learning B) Lecture hle tal engineering rt successfully, students have reached the following leare able to define in details and to choose design appropriate approaches are able to select and apply appropriate approaches are able to deploy their gained knowledge in application of ports. Additionally, they will be able to work in termination in the study Time 110, Study Time in Lecture 70 of the examination is 150 min. The examination includes standing of the lecture contents and calculations tasks ing: Specialisation Structural Engineering: Elective Coding: Specialisation Geotechnical Engineering: Compulsory Management and Engineering: Specialisation II. Computation of the standing of the lecture contents and calculations tasks ing: Specialisation Coastal Engineering: Compulsory Management and Engineering: Specialisation II. Computation of the lecture contents and calculations tasks ing: Specialisation Coastal Engineering: Compulsory Management and Engineering: Specialisation II. Computations tasks and calculations tasks ing: Specialisation Coastal Engineering: Specialisation II. Computations tasks and calculations tasks ing: Specialisation Coastal Engineering: Specialisation II. Computations tasks and calculations tasks ing: Specialisation Coastal Engineering: Specialisation III. Computations tasks and calculations tasks ing: Specialisation Coastal Engineering: Specialisation III.	Lecture 2 Project-/problem-based 1 Learning Lecture 2 Project-/problem-based 1 Learning Lecture 2 hile tal engineering rt successfully, students have reached the following learning resurare able to define in details and to choose design approaches for rt and apply them to design tasks. They can design the fundamentare able to select and apply appropriate approaches for the function are able to select and apply appropriate approaches for the function are able to deploy their gained knowledge in applied problem ign of ports. Additionally, they will be able to work in team with enging of ports. Additionally, they will be able to work in team with enging in the lecture to independently extend their knowledge and applied problem in the independent independent in the i



Course L0809: Harbou	r Engineering
Тур	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	 Fundamentals of harbor engineering Maritime transportation and waterways engineering Ships Elements of harbors Harbor approaches and water-side harbor areas Terminal design and handling of cargo Quay-walls and piers Equipment of harbors Sluices and other special constructions Connection to inland transportation / inland waterway transportation Protection of harbors Breakwaters and Jetties Wave protection of harbors Fishery and other small harbors
Literature	Brinkmann, B.: Seehäfen, Springer 2005

Course L1414: Harbour Engineering	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Frank Feindt
Language	DE
Cycle	SoSe
Content	 Planning and implementation of major projects Market analysis and traffic relations Planning process and plan Port planning in urban neighborhood Development of the logistics center "Port of Hamburg" in the metropolis Quays and waterfront structure Special planning Law Harbor - securing of a flexible use of the port Dimensioning of quays Flood protection structures Port of Hamburg - Infrastructure and development Preparation of areas Scour formation in front of shore structures



Module M0861: N	lodelling of Hydraulic Engineeri	ng		
Courses				
Title		Тур	Hrs/wk	СР
Hydraulic Models (L0813)		Project-/problem-based Learning	1	1
Modelling of Waves (L081	2)	Project-/problem-based	1	1
Modelling of Flow in Rivers	s and Estuaries (L0810)	Learning Lecture	3	4
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Coastal Hydraulic Engineering I			
Educational Objectives	After taking part successfully, students have	reached the following lea	arning resu	lts
Professional Competence				
Knowledge	Students are able to define in detail the basic processes that are related to the modelling of flows in hydraulic engineering. Besides, they can describe the basic aspects of numerical modelling and actual numerical models for the simulation of flows and waves.			
Skills	Students are able to apply hydrodynamic-numerical models to practical hydraulic engineering tasks.			
Personal				
Competence				
Social Competence	The students are able to deploy their of Additionally, they will be able to work in team	_	mple appli	ied problems.
Autonomy	The students will be able to independent problems.	tly extend their knowled	lge and ap	oply it to new
Workload in Hours	Independent Study Time 110, Study Time in	Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 3 hours. general understanding of the lecture conten			respect to the
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Civil Engineering: Specialisation Geotechnicivil Engineering: Specialisation Coastal Er	cal Engineering: Elective	Compulsor	ry



Course L0813: Hydraulic Models	
Тур	Project-/problem-based Learning
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	 Fundamentals of hydraulic models Model laws Pi theorem of Buckingham Practical examples of hydraulic models
Literature	Strobl, Zunic: Wasserbau, Kap. 11 Hydraulische Modelle, Springer

Course L0812: Modelling of Waves		
	Project-/problem-based Learning	
Hrs/wk		
СР		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE/EN	
Cycle	SoSe	
Content	 Waves, interactions with shallow water and constructions Wave theories Sea state and surges Development of waves Wave spectra Modelling of Waves / phase averaged and phase resolved models Application of a phase averaged model for wave prediction (SWAN) Application of phase resolved wave models (Mike) 	
Literature	Vorlesungsumdruck	



Course L0810: Modelling of Flow in Rivers and Estuaries	
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Dr. Edgar Nehlsen, Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	Basics of numerial models / application of models
Literature	Vorlesungsskript



Module M0874: V	Vastewater Systems			
Courses				
Title Wastewater Systems - Co		Typ Lecture Recitation Section (large) Lecture Recitation Section (large)	2	CP 2 1 2 1
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	INONA			
Recommended Previous Knowledge	tue etme ent	nd the key processes	involved in	wastewate
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning results	3
Professional Competence Knowledge	Students are able to outline key areas of the full range of treatment systems in waste water			
Skills	Students are able to pre-design and explain the available wastewater treatment processes and the scope of their application in municipal and for some industrial treatment plants.			
Personal Competence				
Social Competence	Social skills are not targeted in this module.			
Autonomy	Students are in a position to work on a subject. They can also present on this subject.	ct and to organize their v	work flow inc	dependently
Workload in Hours	Independent Study Time 96, Study Time in Le	cture 84		
Credit points	6			
Studienleistung	I			
	Written exam			
Examination duration and scale	1120 min			
	Civil Engineering: Specialisation Structural Er Civil Engineering: Specialisation Geotechnical Civil Engineering: Specialisation Coastal Engineering: Specialisation Water and T Bioprocess Engineering: Specialisation Water and T Georgy and Environmental Engineering: Specialisation A Compulsory Energy and Environmental Engineering: Specialisation Management and Engineering Engineering: Elective Compulsory International Management and Engineering Biotechnology: Elective Compulsory Process Engineering: Specialisation Encompulsory Process Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Specialisation Process Specialisation Engineering: Specialisation Process Specialisation Engineering:	al Engineering: Elective of ineering: Elective Compineering: Elective Compineering: Elective Compineering: Compulsory - General Bioprocess ecialisation Environment g: Specialisation II. Encountry vironmental Process Engineering: Elective Calisation Water: Compul	Compulsory bulsory bulsory see Engineeri tal Engineer ergy and Er occess Engineerin ompulsory sory	ing: Elective nvironmental neering and g: Elective



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Wastewater Systems - Collection, Treatment and Reuse		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Ralf Otterpohl	
Language	EN	
Cycle	SoSe	
Content	 •Understanding the global situation with water and wastewater •Regional planning and decentralised systems •Overview on innovative approaches •In depth knowledge on advanced wastewater treatment options for different situations, for end-of-pipe and reuse •Mathematical Modelling of Nitrogen Removal •Exercises with calculations and design 	
Literature	Henze, Mogens: Wastewater Treatment: Biological and Chemical Processes, Springer 2002, 430 pages George Tchobanoglous, Franklin L. Burton, H. David Stensel: Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy McGraw-Hill, 2004 - 1819 pages	

Course L0943: Wastev	ourse L0943: Wastewater Systems - Collection, Treatment and Reuse	
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Ralf Otterpohl	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0357: Advanced Wastewater Treatment			
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Joachim Behrendt		
Language	DE		
Cycle	SoSe		
	Survey on advanced wastewater treatment		
	reuse of reclaimed municipal wastewater		
	Precipitation		
	Flocculation		
	Depth filtration		
Content	Membrane Processes		
	Activated carbon adsorption		
	Ozonation		
	"Advanced Oxidation Processes"		
	Disinfection		
	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003		
	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987		
Literature	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007		
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006		
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003		



Course L0358: Advance	ced Wastewater Treatment
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
	Aggregate organic compounds (sum parameters)
	Industrial wastewater
	Processes for industrial wastewater treatment
	Precipitation
Content	Flocculation
	Activated carbon adsorption
	Recalcitrant organic compounds
	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003
	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987
	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003



Courses				
Title City Planning (L1066)	Typ Project-/problem- Learning	Hrs/wk CP -based 4 6		
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	INONA			
•	for "Principles of Urban Planning": none			
	for "Designing Urban Streetscapes": some knowledge of treatsking the undergraduate class "Transport Planning and Traffic			
Educational Objectives	After taking part successfully students have reached the follow	wing learning results		
Professional Competence				
Knowledge	Students are able to: use technical terms of urban planning. describe the main determinants of urban development. explain and compare different possibilities of how urban development can influenced. discuss requirements for public streetscapes. explain the importance of street design.			
Skills	Students are able to: • read and analyze urban development concepts and designs for streetscapes • appraise such concepts in the context of competing requirements. • design, justify and reflect their own solutions for concrete examples.			
Personal Competence				
Social Competence	 discuss intermediate results with each other. constructively accept feedback on their own work. provide constructive feedback to others. 			
Autonomy	Students are able to: independently complete a written report including drawings following a broadly predefined process. assess the consequences of their proposed solutions. independently acquire knowledge and apply this to new issues or problem areas. 			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			



Credit points	6				
Studienleistung					
Examination	Written elaboration				
Examination duration and scale	I written assignment, designwork during the semester				
Assignment for the Following Curricula	H odistics intrastructure and Mobility. Specialisation intrastructure and Mobility. Electivel				

ourse L1066: City Pla	anning			
Тур	Project-/problem-based Learning			
Hrs/wk	4			
СР	3			
Workload in Hours	ndependent Study Time 124, Study Time in Lecture 56			
Lecturer	Prof. Carsten Gertz			
Language	DE			
Cycle	SoSe			
Content	"Principles of Urban Planning" deals with the determinants of urban development and thei interactions. Topics include: • legal framework, • instruments and methods of planning, • functional requirements, • stakeholders and actors • basic design requirements • different planning levels and • historical contexts. The objective of the course is for students to acquire a basic understanding of urbar development problems and approaches for solving them. They will also be able to comprehend the process of urban planning. The course also covers the various functional and aesthetic requirements for designing streetscape as the most important elements of public space. The project work deals with a real life scenario and includes drawing up a development plan an urban design concept, a building masterplan and a street redesign.			
Literature	Albers, Gerd; Wekel, Julian (2009) Stadtplanung: Eine illustrierte Einführung. Primus Verlag Darmstadt. Frick, Dieter (2008) Theorie des Städtebaus: Zur baulich-räumlichen Organisation von Stad Wasmuth-Verlag. Tübingen Jonas, Carsten (2009) Die Stadt und ihr Grundriss. Wasmuth-Verlag. Tübingen Kostof, Spiro; Castillo, Greg (1998) Die Anatomie der Stadt. Geschichte städtischer Strukturer Campus-Verlag. Frankfurt/New York.			



Module M0977: C	onstruction Lo	ogistics and Pro	oject Management		
Courses					
Title Construction Logistics (L1163) Construction Logistics (L1164) Project Development and Management (L1161) Project Development and Management (L1162)		Typ Lecture Recitation Section (sr Lecture Project-/problem-base Learning	1	CP 2 2 1	
Module Responsible	Prof. Heike Flämig				
Admission Requirements	None				
Recommended Previous Knowledge	none				
Educational Objectives	After taking part suc	cessfully, students ha	ve reached the following	learning resu	Its
Professional Competence					
Knowledge	Students can give definitions of the main terms of construction logistics and project development an management name advantages and disadvantages of internal or external construction logistics explain characteristics of products, demand and production of construction objects an their consequences for construction specific supply chains differentiate constructions logistics from other logistics systems				
Skills	 carry out project life cycle assessments apply methods and instruments of construction logistics apply methods and instruments of project development and management apply methods and instruments of conflict management design supply and waste removal concepts for a construction project 				
Personal Competence	Students can				
Social Competence	hold presentapply method	ations in and for grou ds of conflict solving s	ps skills in group work and c	ase studies	
Autonomy	Students can solve problems by holistic, systemic and flow oriented thinking improve their creativity, negotiation skills, conflict and crises solution skills by applying methods of moderation in case studies				
Workload in Hours	Independent Study	Time 124, Study Time	e in Lecture 56		
Credit points					
Studienleistung					
	Written elaboration				
Examination duration and scale	Two written papers		<u> </u>		
	Civil Engineering: S	pecialisation Structur	al Engineering: Elective	Compulsory	



	Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory			
Assignment for the	International Management and Engineering: Specialisation II. Civil Engineering: Elective			
Following Curricula	Compulsory			
	International Management and Engineering: Specialisation II. Logistics: Elective Compulsory			
	Logistics, Infrastructure and Mobility: Specialisation Production and Logistics: Elective			
	Compulsory			
	Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective			
	Compulsory			

Course L1163: Constr	uction Logistics			
Тур	Lecture			
Hrs/wk	1			
СР	2			
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14			
Lecturer	Prof. Heike Flämig			
Language	DE			
Cycle	SoSe			
Content	The lecture gives deeper insight how important logistics are as a competetive factor for construction projects and which issues are to be adressed. The following toppics are covered:			
Literature	Contents of the lecture are deepened in special exercises. Flämig, Heike: Produktionslogistik in Stadtregionen. In: Forschungsverbund Ökologische Mobilität (Hrsg.) Forschungsbericht Bd. 15.2. Wuppertal 2000. Krauss, Siri: Die Baulogistik in der schlüsselfertigen Ausführung, Bauwerk Verlag GmbH Berlin 2005. Lipsmeier, Klaus: Abfallkennzahlen für Neubauleistungen im Hochbau: Verlag Forum für Abfallwirtschaft und Altlasten, 2004. Schmidt, Norbert: Wettbewerbsfaktor Baulogistik. Neue Wertschöpfungspotenziale in der Baustoffversorgung. In: Klaus, Peter: Edition Logistik. Band 6. Deutscher Verkehrs-Verlag. Hamburg 2003. Seemann, Y.F. (2007): Logistikkoordination als Organisationseinheit bei der Bauausführung Wissenschaftsverlag Mainz in Aachen, Aachen. (Mitteilungen aus dem Fachgebiet Baubetrieb und Bauwirtschaft (Hrsg. Kuhne, V.): Heft 20)			



Course L1164: Construction Logistics		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Heike Flämig	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1161: Project Development and Management		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei	
Language	DE	
Cycle	SoSe	
Content	 Within the lecture, the main aspects of project development and management are tought: Terms and definitions of project management Advantages and disadvantages of different ways of project handling organization, information, coordination and documentation cost and fincance management in projects time- and capacity management in projects specific methods and instruments for successful team work Contents of the lecture are deepened in special exercises.	
Literature	Projektmanagement-Fachmann. Band 1 und Band 2. RKW-Verlag, Eschborn, 2004.	

Course L1162: Project Development and Management		
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0998: S	Statics and Dynamics of Structure	s		
Courses				
Title		Тур	Hrs/wk	СР
Structural Dynamics (L12	02)	Lecture	2	2
Structural Dynamics (L12		Recitation Section (large)	2	2
	fatigue in steel structures (L0564)	Lecture	1	1
Fracture Mechanics and	Fatigue (L0565)	Recitation Section (large)	1	1
Module Responsible				
Admission Requirements	INONA			
Recommended Previous Knowledge	Knowledge of linear structural analysis of stat Mechanics I/II, Mathematics I/II, Differential equ	•	indetermina	ate structures
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning resul	ts
Professional				
Competence				
Knowledge Skills	After successful completion of this module, the material and structures to dynamics loading u and methods.		•	
Personal				
Competence				
	Students can			
Social Competence	 participate in subject-specific and inter defend their own work results in front o promote the scientific development of c Furthermore, they can give and accept 	f others colleagues		
Autonomy	Students are able to gain knowledge of the apply it to new problems. Furthermore, they problems in the area of Structural Analysis.	-		
Workload in Hours	Independent Study Time 96, Study Time in Le	cture 84		
Credit points	6			
Studienleistung	None			
	Written exam			
Examination duration and scale	I 150 min			
Assignment for the	Civil Engineering: Specialisation Structural En Civil Engineering: Specialisation Geotechnica Civil Engineering: Specialisation Coastal Engi	I Engineering: Elective	•	у



Following Curricula	Following Curricula Civil Engineering: Specialisation Water and Traffic: Elective Compulsory						
	International	Management and	Engineering:	Specialisation	II. Civil	Engineering:	Elective
	Compulsory						

Course L1202: Structural Dynamics				
Typ Lecture				
Hrs/wk	2			
СР	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Prof. Uwe Starossek			
Language	DE			
Cycle	SoSe			
Content	 Single-degree-of-freedom systems: undamped and damped vibration, free vibration, forced vibrations due to harmonic, periodical or arbitrary loading, natural frequency, damping vibration isolation solution in the frequency-domain (Fourier transformation), solution in the time-domain multi-degree-of-freedom systems: continuous or discrete systems, modelling with finite elements, generalisation modal analysis power iteration according to v.Mises earthquake loading: seismological basics, response spectrum method wind-induced vibrations: engineering meteorology, aerodynamic, classification of excitation mechanisms progressive collapse			
Literature	Clough, R.W., Penzien, J.: Dynamics of Structures. 2. Aufl., McGraw-Hill, New York, 1993.			

Course L1203: Structural Dynamics		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



	re mechanics and fatigue in steel structures			
	Lecture			
Hrs/wk				
СР				
	Independent Study Time 16, Study Time in Lecture 14			
	Dr. Ingo Hadrych			
Language				
Cycle				
	 basics of fatigue stress and fatigue resistance and determination of fatigue strength, determination anduse of S-N-curves and classification of notch effects, 			
Content	 set up of determination of fatigue strength under dynamic load using the accumulatiformula by Palmgren-Miner, 			
	· set up of determination of fatigue strength in different examples,			
	 basics of construction and design regarding the problem of material fatigue, 			
	· basics of linear elastic fracture mechanics under static and dynamic load,			
	 determination of lifetime of steel construction based on linear elastic fracture mechanics different examples. 			
	 Seeßelberg, C.; Kranbahnen - Bemessung und konstruktive Gestaltung; 3. Auflage; Bauwerk-Verlag; Berlin 2009 Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 200 Verlag Ernst & Sohn; Berlin 2003 			
	 Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Auflag Stahlbau-Verlagsgesellschaft; Köln 1996 			
	Petersen, C.; Stahlbau; 3. überarb. und erw. Auflage; Vieweg-Verlag; Braunschweig 1993			
	 DIN V ENV 1993-1-1: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; T 1-1: Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993 			
	 DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil Kranbahnen; 2001 			
Literature	 DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; National Anwendungsdokument (NAD); Berlin 2002 			



Course L0565: Fracture Mechanics and Fatigue		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Ingo Hadrych	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0999: S	Steel Construction Proj	ect		
Courses				
Title	4 (I 400C)	Typ	Hrs/wk	СР
Steel Construction Project		Project Seminar	4	6
Module Responsible Admission Requirements				
Recommended Previous Knowledge	I Staal and Lomnoelta Striictiira	s		
Educational Objectives	I ATTOR TOKING NORT CHICCOCCTIHIN C	tudents have reached the followin	g learning resu	Its
Professional Competence				
Knowledge	Students are able to prepare a	part of the whole project and expl	ain it to the othe	ers.
Skills	•	s and calculations of their part of o changing conditions resulting		•
Personal				
Competence	! 	ılts to other members of the group		
Social Competence	They have the ability to work fo	r a broad agreement with respect	to intergroup de	ependencies.
	They can distribute and proces	s tasks independently.		
Autonomy	Students can handle their part	of the project on their own resposi	bility-	
Workload in Hours	Independent Study Time 124, S	Study Time in Lecture 56		
Credit points	6			
Studienleistung	None			
Examination	Written elaboration			
Examination duration and scale	approx. 15-20 pages (without a	appendix)		
Assignment for the Following Curricula	Civil Engineering: Specialisation	on Geotechnical Engineering: Elective (on Coastal Engineering: Elective (on Structural Engineering: Compu	Compulsory	ry

Course L1206: Steel Construction Project		
Тур	Project Seminar	
Hrs/wk	4	
СР	6	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Lecturer	Prof. Marcus Rutner	
Language	DE	
Cycle	SoSe	
Content	Design of a big construction project (i.e skyscraper, large bridge, roof of a stadiuim) in small groups	
Literature	Wird je nach Projekt individuell angegeben.	



Module M0663: N	Marine Geotechnics and Numerics	;		
Courses				
Title Marine Geotechnics (L05- Marine Geotechnics (L05- Numerical Methods in Geo	49)	Typ Lecture Recitation Section (large) Lecture	Hrs/wk 1 1 3	CP 2 1 3
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements				
Recommended Previous Knowledge	complete modules: Geotechnics I-II, Mathema courses: Soil laboratory course	tics I-III		
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence Knowledge				
Skills Personal Competence Social Competence Autonomy				
	I	ecture 70		
Credit points				
Studienleistung				
	Written exam			
Examination duration and scale	190 min			
Assignment for the Following Curricula	Civil Engineering: Specialisation Geotechnica Civil Engineering: Specialisation Structural Er Civil Engineering: Specialisation Coastal Eng Theoretical Mechanical Engineering: Special Compulsory Theoretical Mechanical Engineering: Technical Water and Environmental Engineering: Special Water and Environmental Engineering: Special Water and Environmental Engineering: Special	ngineering: Elective Con ineering: Compulsory pecialisation Maritime al Complementary Cour alisation Cities: Elective alisation Environment: E	Technologies: Elective Compulsor Elective Com	Compulsory y npulsory



Course L0548: Marine	Geotechnics
Тур	Lecture
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	 Geotechnical investigation an description of the seabed Foundations of Offshore-Constructions cCliff erosion Sea dikes Port structures Flood protection structures
Literature	 EAK (2002): Empfehlungen für Küstenschutzbauwerke EAU (2004): Empfehlungen des Arbeitsausschusses Uferbauwerke Poulos H.G. (1988): Marine Geotechnics. Unwin Hyman, London Wagner P. (1990): Meerestechnik: Eine Einführung für Bauingenieure. Ernst & Sohn, Berlin

Course L0549: Marine Geotechnics	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0375: Numerical Methods in Geotechnics		
Тур	Lecture	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Dr. Hans Mathäus Stanford	
Language	DE	
Cycle	SoSe	
Content	Topics: numerical simulations numerical algorithms finite element method application of finite element method in geomechanics constitutive models for soils contact models for soil structure interaction selected applications	
Literature	 Wriggers P. (2001): Nichtlineare Finite-Elemente-Methoden, Springer Verlag, Berlin Bathe Klaus-Jürgen (2002): Finite-Elemente-Methoden. Springer Verlag, Berlin 	



Courses					
Title Anchor Technology and Design, Post Installed Rebar Connections (L0257) Repair of Structures (L0255)		Typ Recitation Section (small) Lecture	1	CP 1	
Mineral Building Materials Technology of mineral Bu			Lecture Project-/problem-based Learning	1	1
Transport Processes in B	uilding Materials and Damage Pr	ocesses (L0254)	Lecture	1	1
Module Responsible	Prof. Frank Schmidt-Döhl				
Admission Requirements	None				
Recommended Previous Knowledge	Basic knowledge about but example by the modules Pre Materials and Building Chen	inciples of Buildin			
Educational Objectives	After taking part successfully	, students have rea	ached the following lea	rning resu	Its
Professional Competence					
	The students are able to describe the components of mineral building materials and their function in detail and to use them for the manufacture of special mineral building materials. They are able to show the characteristics of mineral building materials. They are able to describe the manufacture, properties and fields of application of special mortars and special concretes and the correlations of their material parameters. They are able to show the principles of anchor technology and design.				
Skills	The students are able to paterial. They are able to destudents are able to manufacture damages, to assess possib and to select repair and stream	esign a special mir cture post installed le causes, to use	neral mortar and to man d rebar connections. Th the fundamentals of c	ufacture they are abl	nis mortar. Th e to recogniz
Personal Competence Social Competence	The students are able to develope their results to the lecturer adjust their results. The students of this feedback.	and the other stud	dents. In a critical disc	ussion the	ey defend an
Autonomy	The students are able to re their project and to investiga			s and lab	equipment fo
Workload in Hours	Independent Study Time 96,	Study Time in Lec	eture 84		
Credit points					
Studienleistung	Yes 20 %	orm ubject theoret ractical work	Descriptio ical and	n	
Examination	Written exam				
Examination duration and scale	120 min				
-					



Assignment for the
Following Curricula

Civil Engineering: Specialisation Geotechnical Engineering: Compulsory
Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Civil Engineering: Specialisation Structural Engineering: Elective Compulsory

Civil Engineering: Specialisation Water and Traffic: Elective Compulsory

Course L0257: Anchor	Technology and Design, Post Installed Rebar Connections
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	 Working principles of friction, keying and bonding anchors Selection of anchors Anchor design Installation of anchors Post installed rebar connections and additional german regulations
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung Beton-Kalender 2012: Infrastrukturbau, Befestigungstechnik. Eurocode 2. Herausgegeben von Konrad Bergmeister, Frank Fingerloos und Johann-Dietrich Wörner; 2012 Ernst & Sohn GmbH & Co. KG. Published by Ernst & Sohn GmbH & Co. KG. DIBt: Hinweise für die Montage von Dübelverankerungen; Oktober 2010 Ratgeber Dübeltechnik, Basiswissen - Metalldübel, chemische Dübel, Kunststoffdübel; Herausgeber Hilti AG

Course L0255: Repair of Structures	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Maintenance of structures, repair and strengthening, subsequent waterproofing of structures
Literature	BetonMarketing Deutschland (Hrsg.): Stahlbetonoberflächen - schützen, erhalten, instandsetzen



Course L0253: Minera	Course L0253: Mineral 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	SoSe	
Content	Components of mineral building materials and their function, binding materials, concrete and mortar, special mortars, special concretes	
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis	

Course L0256: Technology of mineral Building Materials		
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	SoSe	
Content	Design and production of a special mineral building material	
	Taylor, H.F.W.: Cement Chemistry	
Literature	Springenschmid, R.: Betontechnologie für die Praxis	

Course L0254: Transport Processes in Building Materials and Damage Processes	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl, Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	Transport Processes in Building Materials and Damage Processes
Literature	Blaich, J.: Bauschäden, Analyse und Vermeidung



Module M0581: V				
Courses				
Title		Тур	Hrs/wk	СР
	stewater Management (L0226) stewater Management (L2008)	Lecture Project Seminar	3 3	3 3
Module Responsible	<u> </u>		-	
Admission				
Requirements	None			
Recommended Previous Knowledge	Good knowledge of wastewa	rainage;	and their prope	rties;
Educational Objectives	After taking part successfully, studer	nts have reached the followin	g learning resu	lts
Professional				
Competence	! !	sic principles of the regulate	ory framowork	related to th
Knowledge	The students can describe the basic principles of the regulatory framework related to the international and European water sector. They can explain limnological processes, substance cycles and water morphology in detail. They are able to assess complex problems related to water protection, such as ecosystem service and wastewater treatment with a special focus on innovative solutions, remediation measures as well as conceptual approaches.			
Skills	Students can accurately assess current problems and situations in a country-specific or local context. They can suggest concrete actions to contribute to the planning of tomorrow's urban water cycle. Furthermore, they can suggest appropriate technical, administrative and legislative solutions to solve these problems.			
Personal				
Competence				
	The students can work together in ir	nternational groups.		
Social Competence				
•				
	Students are able to organize their can acquire appropriate knowledge			cussions. The
Autonomy				
,				
Workload in Hours	Independent Study Time 96, Study	Time in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration	160 min			
and scale				



Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory
Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Compulsory

Course L0226: Water I	Protection and Wastewater Management
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 Regulatory Framework (e.g. WFD) Main instruments for the water management and protection In depth knowledge of relevant measures of water pollution control Urban drainage, treatment options in different regions on the world Rainwater management, improved management of heavy rainfalls, downpours, rainwater harvesting, rainwater infiltration Case Studies and Field Trips
Literature	 The literature listed below is available in the library of the TUHH. Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International. Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011) New York, NY: McGraw-Hill. Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Course L2008: Water Protection and Wastewater Management	
Тур	Project Seminar
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	
Literature	



Module M0595: E	Examination of Materials, Structural Condition and Damages		
Courses			
	Typ Hrs/wk C Structural Condition and Damages (L0260) Lecture 4 4 Structural Condition and Damages (L0261) Recitation Section (small) 1 2		
Module Responsible	Prof. Frank Schmidt-Döhl		
Admission Requirements	None		
	Basic knowledge about building materials or material science, for example by the Building Materials and Building Chemistry.	he module	
Educational Objectives	I Affar taking part currectilly, etudente have reached the following learning reculte		
Professional Competence			
Knowledge	The students are able to describe the rules for trading, use and marking of construction products in Germany. They know which methods for the testing of building material properties are usable and know the limitations and characterics of the most important testing methods.		
Skills	The students are able to responsibly discover the rules for trading and using of building products in Germany. They are able to chose suitable methods for the testing and inspection of construction products, the examination of damages and the examination of the structural conditions of buildings. They are able to conclude from symptons to the cause of damages. They are able to describe an examination in form of a test report or expert opinion.		
Personal Competence			
Social Competence	The students can describe the different roles of manufacturers as well as testing, s and certification bodies within the framework of material testing. They can de different roles of the participants in legal proceedings.		
Autonomy	The students are able to make the timing and the operation steps to learn the knowledge of a very extensive field.	e specialist	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70		
Credit points			
Studienleistung			
	Written exam		
Examination duration and scale	112() min		
Assignment for the Following Curricula		g: Elective	



Course L0260: Examination of Materials, Structural Condition and Damages	
Тур	Lecture
Hrs/wk	4
СР	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	Materials testing and marking process of construction products, testing methods for building materials and structures, testing reports and expert opinions, describing the condition of a structure, from symptons to the cause of damages
Literature	Frank Schmidt-Döhl: Materialprüfung im Bauwesen. Fraunhofer irb-Verlag, Stuttgart, 2013.

Course L0261: Examination of Materials, Structural Condition and Damages	
Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses				
Title Nonlinear Structural Analy	veis (1 0277)	Typ Lecture	Hrs/wk	CP 4
Nonlinear Structural Analy		Recitation Section (small)	•	2
Module Responsible	Prof. Alexander Düster			
Admission Requirements	None			
Recommended Previous Knowledge	Knowledge of partial differential equations is	recommended.		
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional				
Competence				
Knowledge	Students are able to + give an overview of the different nonlinear phenomena in structural mechanics. + explain the mechanical background of nonlinear phenomena in structural mechanics. + to specify problems of nonlinear structural analysis, to identify them in a given situation and to explain their mathematical and mechanical background.			
Skills	Students are able to + model nonlinear structural problems. + select for a given nonlinear structural problem a suitable computational procedure. + apply finite element procedures for nonlinear structural analysis. + critically verify and judge results of nonlinear finite elements. + to transfer their knowledge of nonlinear solution procedures to new problems.			
Personal Competence				
Social Competence	Students are able to			
Autonomy	Students are able to + acquire independently knowledge to solve complex problems.			
Workload in Hours	Independent Study Time 124, Study Time in	Lecture 56		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	120 min			
_	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Materials Science: Specialisation Modeling: Elective Compulsory Mechatronics: Specialisation System Design: Elective Compulsory Product Development, Materials and Production: Core qualification: Elective Compulsory Naval Architecture and Ocean Engineering: Core qualification: Elective Compulsory Ship and Offshore Technology: Core qualification: Elective Compulsory Theoretical Mechanical Engineering: Core qualification: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory			

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Course L0277: Nonline	ear Structural Analysis
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Alexander Düster
Language	DE/EN
Cycle	WiSe
Content	 Introduction Nonlinear phenomena Mathematical preliminaries Basic equations of continuum mechanics Spatial discretization with finite elements Solution of nonlinear systems of equations Solution of elastoplastic problems Stability problems Contact problems
Literature	 [1] Alexander Düster, Nonlinear Structrual Analysis, Lecture Notes, Technische Universität Hamburg-Harburg, 2014. [2] Peter Wriggers, Nonlinear Finite Element Methods, Springer 2008. [3] Peter Wriggers, Nichtlineare Finite-Elemente-Methoden, Springer 2001. [4] Javier Bonet and Richard D. Wood, Nonlinear Continuum Mechanics for Finite Element Analysis, Cambridge University Press, 2008.

Course L0279: Nonlinear Structural Analysis	
Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Alexander Düster
Language	DE/EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1350: E	excavation Law and Projects			
Courses				
Title		Тур	Hrs/wk	СР
Subsoil and Underground	Engineering Law (L0395)	Lecture	2	2
Service Contract and Pro	curement Law (L1906)	Lecture	2	2
Project Geotechnics (L07	08)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge				
Educational Objectives	After taking part successfully, students I	nave reached the following lea	arning resul	ts
Professional Competence				
Knowledge				
Skills				
Personal				
Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time	e in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Oral exam			
Examination duration and scale	15 min			
_	Civil Engineering: Specialisation Coast Civil Engineering: Specialisation Geote Civil Engineering: Specialisation Struct Civil Engineering: Specialisation Water	chnical Engineering: Elective ural Engineering: Elective Cor	Compulsor npulsory	у



Course L0395: Subsoi	l and Underground Engineering Law
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Georg-Friedger Drewsen
Language	DE
Cycle	WiSe
Content	 Introduction Historical Overview Areas of civil law The Contracting Parties Authorities, Cooperatioves and other patries involved The Civil law The Public Service Obligations Land acquisition Planning of underground construction projects The construction contract according to BGB/VOB - design and implementation The civil law in the jurisdiction
Literature	Folienskipt (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner- Verlag

Course L1906: Service	ourse L1906: Service Contract and Procurement Law		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Günther Schalk, Prof. Jürgen Grabe		
Language	DE		
Cycle	WiSe		
Content			
Literature			



Course L0708: Project	Geotechnics
Тур	Project-/problem-based Learning
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	The students solve independently a project-based geotechnical problem in groups. Additional lectures concerning the problem will be held and material will be distributed as study basis. Every two weeks the groups present their current project status. The final work will be presentated in a final presentation.
Literature	abhängig von der Fragestellung



Courses					
Title Waste and Environmental	Chemistry (L0328)		Typ Practical Course	Hrs/wk 2	CP 2
Biological Waste Treatme	nt (L0318)		Project-/problem-based Learning	3	4
Module Responsible	Prof. Kerstin Kuchta				
Admission Requirements	None				
Recommended Previous Knowledge	chemical and biological b	oasics			
Educational Objectives	After taking part successf	fully, students have re	ached the following lea	ırning resul	ts
Professional Competence					
Knowledge	The module aims possess knowledge concerning the planning of biological waste treatment plants. Students are able to explain the design and layout of anaerobic and aerobic waste treatment plants in detail, describe different techniques for waste gas treatment plants for				
Skills	The students are able to discuss the compilation of design and layout of plants. They car critically evaluate techniques and quality control measurements. The students can recherche and evaluate literature and date connected to the tasks given in der module and plar additional tests. They are capable of reflecting and evaluating findings in the group.				
Personal Competence	Students can participat	to in subject specifi	e and interdisciplinar	v discussi	ons develo
Social Competence	cooperated solutions an scientific development	d defend their own vin front of colleagu	vork results in front of	others and	d promote the
Autonomy	Students can independently tap knowledge from literature, business or test reports and transform it to the course projects. They are capable, in consultation with supervisors as well as in the interim presentation, to assess their learning level and define further steps on this basis. Furthermore, they can define targets for new application-or research-oriented duties in accordance with the potential social, economic and cultural impact.				
Workload in Hours	Independent Study Time	110, Study Time in Le	ecture 70		
Credit points	6				
Studienleistung	Compulsory Bonus Yes None	Form Subject theoret	Descriptio ical and	on	
Pagastrati		practical work			
Examination Examination duration					
	Elaboration and Presenta				



Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Core qualification: Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Energy: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory
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Course L0328: Waste	and Environmental Chemistry
Тур	Practical Course
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
Language	DE/EN
Cycle	WiSe
Content	The participants are divided into groups. Each group prepares a transcript on the experiment performed, which is then used as basis for discussing the results and to evaluate the performance of the group and the individual student. In some experiments the test procedure and the results are presented in seminar form, accompanied by discussion and results evaluation. Experiments ar e.g. Screening and particle size determination Fos/Tac AAS Chalorific value
Literature	Scripte



Course L0318: Biologi	cal Waste Treatment
Тур	Project-/problem-based Learning
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	 Introduction biological basics determination process specific material characterization aerobic degradation (Composting, stabilization) anaerobic degradation (Biogas production, fermentation) Technical layout and process design Flue gas treatment Plant design practical phase
Literature	



Module M0705: 0	iroundwater			
Courses				
Title		Тур	Hrs/wk	СР
Geohydraulic and Solute		Lecture	2	2
Geohydraulic and Solute		Recitation Section (small)	1	1
Simulation in Groundwate	· Hydrology (L0541)	Lecture	1	1
Simulation in Groundwate	Hydrology (L0542)	Recitation Section (small)	2	2
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	Ground water hydrologyHydromechanics			
Educational Objectives	After taking part successfully, students have rea	ached the following lea	rning result	S
Professional Competence				
Knowledge	The students are able to describe the fate of solutes in the subsurface along the path between soil and water body quantitatively and qualitatively. They are able to do this with simulation models.			
Skills	The students are able to describe conceptually movement and storage of water in the unsaturated zone. They are able to analyse pF- functions and Ku functions. They can mode transport of solutes in the unsaturated and saturated zoned. They are able to determine dispersiities, sorption coefficients, decay rates and dissolution rates for organic and inorgani substances.			
Personal Competence				
Social Competence	The students can help to each other.			
Autonomy				
	Independent Study Time 96, Study Time in Lec	cture 84		
Credit points	· · · · · · · · · · · · · · · · · · ·			
Studienleistung				
	Written exam			
Examination duration and scale	60 min written exam and written papers			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Specialisation Geotechnical Civil Engineering: Specialisation Coastal Engineering: Specialisation Water and Traprocess Engineering: Specialisation Environmental Engineering: Specialisation Process Engineering: Specialisation	Engineering: Elective (neering: Elective Comp affic: Elective Compulso vironmental Process Engineering: Elective Compulso clisation Water: Compulso clisation Environment: E	Compulsory oulsory ory Engineerin ompulsory sory	ng: Elective



Course L0539: Geohydraulic and Solute Transport		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Wilfried Schneider	
Language	DE	
Cycle	WiSe	
Content	Pump test analysis, water content-water suction functions, unsaturated hydraulic conductivity function, Brooks-Corey relation, van Genuchten relation, solute transport in unsaturated zone, solute transport and reactions in groundwater	
Literature	Todd; K. (2005): Groundwater Hydrology Fetter, C.W. (2001): Applied Hydrogeology Hölting & Coldewey (2005): Hydrogeologie Charbeneau, R.J. (2000): Groundwater Hydraulics and pollutant Transport	

Course L0540: Geohydraulic and Solute Transport		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wilfried Schneider	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0541: Simulation in Groundwater Hydrology		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Sonja Schröter	
Language	DE	
Cycle	WiSe	
Content	Basics and theoretical background of simulation models frequently used in science and practise for pumping test analysis, water movement in vadose zone, solute transport in vadose zone, groundwater recharge, solute transport in groundwater	
Literature	Handbücher der verwendeten Slumationsmodelle werden bereitgestellt.	



Course L0542: Simulation in Groundwater Hydrology	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Schröter
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0722: C	Computational Analysis of Concre	te Structures		
Courses				
-	Concrete Structures (L0598) Concrete Structures (L0599)	Typ Lecture Recitation Section (large)	Hrs/wk 2 2	CP 2 2
FE-Modeling of Concrete	Structures (L0600)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
Recommended Previous Knowledge	Lectures 'Structural Analysis I and II'	lesign of reinforced con	icrete struct	ures (beams,
Educational	Lecture 'Concrete Structures'			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence <i>Knowledge</i>	The students know the problems of numerical modeling and design of an arbitrary concrete			
	The students can model and design an arbitrary concrete structure by means of a finite element software package.			
Personal Competence				
Social Competence	The students can model and design in teamwork a real concrete structure by means of a finite element software package.			
Autonomy	The students can model and design a real software package and discuss the problems a			nite element
Workload in Hours	Independent Study Time 96, Study Time in Le	cture 84		
Credit points	6			
Studienleistung				
Examination				
Examination duration and scale	45 min			
_	Civil Engineering: Specialisation Structural Er Civil Engineering: Specialisation Geotechnica Civil Engineering: Specialisation Coastal Eng Civil Engineering: Specialisation Water and To	I Engineering: Elective ineering: Elective	Compulsory oulsory	,



Course L0598: Compu	tational Analysis of Concrete Structures
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 Modeling of beam and truss structures Discontinuity regions, like frame corners, openings, shear walls with large openings Bracing of high-rise buildings Modeling of bridges Nonlinear analysis Finite-Elemente-analysis of slabs: support conditions, singularity regions Finite-Elemente-Berechnungen of shear walls and deep beams: support condition, design Coupled systems Modeling of slab supported on beams Shell structures 3D building models Nonlinear analysis of slabs and shells Documentation
Literature	 Vorlesungsumdruck Rombach, G.A. (2007): Anwendung der Finite-Elemente-Methode im Betonbau. 2. Auflage, Verlag Ernst & Sohn, Berlin Rombach G.A. (2011): Finite-Element Design of Concrete Structures, 2nd edition, ICE publishing Hartmann, F., Katz, C. (2002): Statik mit finiten Elementen. Springer, Berlin

Course L0599: Computational Analysis of Concrete Structures	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L0600: FE-Modeling of Concrete Structures		
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Lukas Henze	
Language	age DE	
Cycle	WiSe	
Content	Finite Element Modeling and computational design of concrete structures by 'SOFiSTiK'	
Literature	 Rombach G.: Anwendung der Finite - Elemente - Methode im Betonbau. 2. Auflage. Verlag Ernst &.Sohn, Berlin, 2007 Rombach G.: Finite-Element Design of Concrete Structures. 2nd edition, ICE Publishing, London, 2011, ISBN 0 7277 32749 Rombach G.: EDV-unterstützte Berechnungen im Stahlbetonbau. in: "Stahlbetonbau aktuell 2014" (ed. Gorris A., Hegger J., Mark P.), Berlin 2014 (S. C1C.36) 	



Module M0801: V	Vater Resources and -Supply			
Courses				
Title Chemistry of Drinking Wa Chemistry of Drinking Wa Water Resource Manager Water Resource Manager	ter Treatment (L0312) ment (L0402)	Typ Lecture Recitation Section (large) Lecture Recitation Section (small)	2	CP 1 2 2 1
Module Responsible		, ,		
Admission Requirements				
Recommended Previous Knowledge	Knowledge of water management and the key	/ processes involved in v	water treati	ment.
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning resul	ts
Professional Competence				
Knowledge	Students will be able to outline key areas of conflict in water management, as well as their mutual dependence for sustainable water supply. They will understand relevant economic, environmental and social factors. Students will be able to explain and outline the organisational structures of water companies. They will be able to explain the available water treatment processes and the scope of their application.			
Skills	Students will be able to assess complex problems in drinking water production and establish solutions involving water management and technical measures. They will be able to assess the evaluation methods that can be used for this. Students will be able to carry out chemical calculations for selected treatment processes and apply generally accepted technical rules and standards to these processes.			
Personal				
Competence Social Competence	Working in a diverse group of specialists, students will be able to develop and document complex solutions for the management and treatment of drinking water. They will be able to take an appropriate professional position, for example representing user interests. They will be able to develop joint solutions in teams of diverse experts and present these solutions to others.			
Autonomy	Students will be in a position to work on a subject independently and present on this subject.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Studienleistung				
	Written exam			
Examination duration and scale	60 min (chemistry) + presentation			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Compulsory Energy and Environmental Engineering: Specialisation Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory			



Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0311: Chemistry of Drinking Water Treatment		
Тур	Lecture	
Hrs/wk	2	
СР	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dr. Klaus Johannsen	
Language	DE	
Cycle	WiSe	
	The topic of this course is water chemistry with respect to drinking water treatment and water distribution	
	Major topics are solubility of gases, carbonic acid system and calcium carbonate, blending, softening, redox processes, materials and legal requirements on drinking water treatment. Focus is put on generally accepted rules of technology (DVGW- and DIN-standards).	
Content	Special emphasis is put on calculations using realistic analysis data (e.g. calculation of pH or calcium carbonate dissolution potential) in exercises. Students can get a feedback and gain extra points for exam by solving problems for homework.	
	Knowledge of drinking water treatment processes is vital for this lecture. Therefore the most important processes are explained coordinated with the course "Water resources management" in the beginning of the semester.	
	MHW (rev. by Crittenden, J. et al.): Water treatment principles and design. John Wiley & Sons, Hoboken, 2005.	
	Stumm, W., Morgan, J.J.: Aquatic chemistry. John Wiley & Sons, New York, 1996.	
Literature	DVGW (Hrsg.): Wasseraufbereitung - Grundlagen und Verfahren. Oldenbourg Industrie Verlag, München, 2004.	
	Jensen, J. N. : A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.	

Course L0312: Chemistry of Drinking Water Treatment		
Тур	Typ Recitation Section (large)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Dr. Klaus Johannsen	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0402: Water Resource Management		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Mathias Ernst	
Language	DE	
Cycle	WiSe	
Content	The lecture provides comprehensive knowledge on interaction of water ressource nanagement and drinking water supply. Content overview: • Current situation of global water resources User and Stakeholder conflicts Wasserressourcenmanagement in urbane Gebieten Rechtliche Aspekte, Organisationsformen Trinkwasserversorgungsunternehmen. Ökobilanzierung, Benchmarking in der Wasserversorgung	
Literature	 Aktuelle UN World Water Development Reports Branchenbild der deutschen Wasserwirtschaft, VKU (2011) Aktuelle Artikel wissenschaftlicher Zeitschriften Ppt der Vorlesung 	

Course L0403: Water Resource Management	
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Mathias Ernst
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0858: C	Coastal Hydraulic Engineering I			
Courses				
Title Basics of Coastal Engineer	ering (L0807)	Typ Lecture	Hrs/wk 3	CP 4
Basics of Coastal Enginee	ering (L1413)	Project-/problem-based Learning	1	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of hydraulic engineering, hydrology	and hydromechanics		
Educational Objectives	After taking part successfully, students have	e reached the following lea	arning resul	lts
Professional Competence				
Knowledge	The students are able to define and explain the basic concepts of coastal engineering and port engineering. They are able to apply the concepts to selected practical problems of coastal engineering. Students can define and determine the basics for design and dimensioning of coastal engineering constructions.			
Skills	The students are capable to apply basic design approaches to selected and pre-defined design tasks in coastal engineering.			
Personal				-
Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems such as the design of coastal protection structures. Additionally, they will be able to work in team with engineers of other disciplines, for instance designing of coastal breakwaters.			
Autonomy	The students will be able to independently extend their knowledge and applyit to new problems.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Studienleistung	None			
-	Written exam			-
	The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory			



Course L0807: Basics	of Coastal Engineering
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	Design-approaches Filter Rubble mound constructions Piles Vertical constructions
Literature	Coastal Engineering Manual, CEM Vorlesungsumdruck

Course L1413: Basics of Coastal Engineering		
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses				
Title ntegrated Transportation	Planning (I 1068)	Typ Project-/problem-based Learning	Hrs/wk	CP 6
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous Knowledge	some knowledge of transport planning, e.g. thro Planning and Traffic Engineerin	ough taking the underg	raduate cl	ass "Transpo
Educational Objectives	After taking part successfully, students have rea	ached the following lea	rning resu	Its
Professional Competence				
Knowledge	 describe interdependencies bet transportation/mobility behaviour explain and evaluate the social, ecologi use policy measures. relate current issues in the area of in opinion on them. 	ical and economic effe	cts of trans	
Skills	Students are able to: quantify important parameters, which in comprehensively examine a pre-define studies perspective and document conventions.	ed or self-selected top	oic from a	transportation
Personal Competence	Students are able to:			
Social Competence	 provide feedback on topical contents ar constructively handle feedback on their produce results in group work and docu 	own work.		
Autonomy	Students are able to: assess potential consequences of their independently plan working on a pre knowledge and use appropriate means	-defined project topic		the necessa
Workload in Hours	Independent Study Time 124, Study Time in Le	cture 56		
Credit points	6			
Studienleistung				



Examination	Written elaboration		
Examination duration and scale	written assignment with presentation during the semester		
Assignment for the	H odistics intrastructure and Mobility. Specialisation intrastructure and Mobility. Electivel		

Course L1068: Integra	ted Transportation Planning
Тур	Project-/problem-based Learning
Hrs/wk	4
СР	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß
Language	DE
Cycle	WiSe
Content	The course will provide students with an understanding of interdependencies between landuse and transportation. Specific topics include a.o.: • interactions between transport and the environment and consequent limitations • characteristics of integrated planning • complex planning processes • interdependencies of location choice and mobility behaviour • transport and land-use policies • project on current issues in transportation studies
Literature	Kutter, Eckhard (2005) Entwicklung innovativer Verkehrsstrategien für die mobile Gesellschaft. Erich Schmidt Verlag. Berlin. Bracher, Tilman u. a. (Hrsg.) (68. Ergänzung 2013) Handbuch der kommunalen Verkehrsplanung. Herbert Wichmann Verlag. Berlin, Offenbach. (Loseblattsammlung mit kontinuierlichen Ergänzungen)



Module M0964: S	Structures in Foundation and	Hydraulic Engineerin	g	
Courses				
Title		Тур	Hrs/wk	СР
	ation and Hydraulic Engineering (L1146)	Lecture	2	3
Underground Constructio Underground Constructio	,	Lecture	1	2 1
	,	Recitation Section (large)	ı	ı
Module Responsible	la contraction of the contractio			
Admission Requirements	None			
	Modules from Bachelor studies Civil and environmental engineering:			
Recommended Previous Knowledge	I • Gentechnics I-II			
Educational Objectives	After taking part successfully, students h	ave reached the following lea	arning resu	Its
Professional				
Competence				
Knowledge	Knowledge of different tunnel construction types as well as special methods and techniques of subsoil construction. The students get deeper knowledge of steel and ground engineering as well as constructions knowledge concerning quay walls. Futhermore, the students get all the neccessary knowledge to design singular construction elements for sheet pile walls and they know how to choose the right construction elements depending on the influencing conditions.			
Skills	Basic knowledge of tunnel design as well as practical skills in structural tunnel analysis Furthermore, the students are able to dimension sheet pile wall construction regarding al construction elements, to choose the suitable construction elements with respect to the influencing conditions, to design all kinds of sheet pile walls (wave sheet pile walls and combined sheet pile walls) and to dimension all construction elements and connections.			
Personal				
Competence] 			
•	Capacity for teamwork concerning project management and design of tunnels.			
	Promotion of independent and creative v		a design e	xercise.
	Independent Study Time 124, Study Tim	e in Lecture 56		
Credit points				
Studienleistung				
	Written exam			
Examination duration and scale	120 minutes			
_	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory			
	l'			



Course L1146: Steel Structures in Foundation and Hydraulic Engineering		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Frank Feindt	
Language	DE	
Cycle	WiSe	
Content	Design of a sheet pile wall, design of a combined sheet pile wall, piles, walings, connections, fatigue	
Literature	EAU 2012, EA-Pfähle, EAB	

Course L0707: Underg	round Constructions
Тур	Lecture
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Marius Milatz
Language	DE
Cycle	WiSe
Content	 Definitions Historical development in tunneling Geology for tunneling Hard rock tunneling (construction composite and machines) Tunnelung in temporarly stable soil with conventional construction methods Tunneling in soft soils (form of supports, shield types, compressed air application) Pipe jacking Tunnel Lining, tunnel supporting structures Calculation approaches for supporting structures in shield-driven tunnels Surveying for tunneling Safety requirements Construction Contract Literature and sources
Literature	 Vorlesung/Übung s. www.tu-harburg.de/gbt

Course L1811: Underground Constructions		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Marius Milatz	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0969: S	elected Topics in Civil Engineering	g		
Courses				
Courses		_		
Title		Гур	Hrs/wk	СР
Analysis of Offshore Struc	,	ecture	1	1
Design of Concrete Struct		ecture	2	2
=		ecture	1	1
•		Recitation Section (large)		1
	3 ()	Seminar	1	1
		Seminar	1	1
Timber Structures (L1151		Seminar	2	2
Glass Structures (L1152)		ecture	2	2
Glass Structures (L1447)		Recitation Section (large)		1
Wind turbine design (L190	·	ecture	1	1
Module Responsible				-
Admission Requirements	None			
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, students have rea	ched the following lea	rning results	S
Professional				
Competence				
Knowledge	 Students are able to find their way through selected special areas within civil an structural engineering. Students are able to explain basic models and procedures in selected special areas civil and structural engineering. Students are able to interrelate scientific and technical knowledge. 			
Skills	 Students are able to apply basic methods in selected areas of civil and structural engineering. 			
Personal				
Competence				
Social Competence				
Autonomy	 Students can chose independently, i knowledge and skills through the election 	-	want to d	leepen th
Workload in Hours	Depends on choice of courses			
Credit points	6			
-	Civil Engineering: Specialisation Structural Eng Civil Engineering: Specialisation Geotechnical I Civil Engineering: Specialisation Coastal Engin	Engineering: Elective (eering: Elective Comp	Compulsory	

Civil Engineering: Specialisation Water and Traffic: Elective Compulsory



Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	
Examination duration and scale	30 min
Lecturer	Dr. Said Fawad Mohammadi
Language	DE/EN
Cycle	SoSe
Content	Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques
Literature	

Course L1840: Design of Concrete Strucutures		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form		
Examination duration and scale	20 min	
Lecturer	Dr. Karl Morgen	
Language	DE	
Cycle	WiSe	
Content		
Literature	Schlaich/Schäfer, Konstruieren im Stahlbau, BetonKalender 2001, TII, Verlag Ernst & Sohn	



Course L0596: Design of Prefabricated Concrete Structures			
Тур	Lecture		
Hrs/wk			
СР			
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Examination Form	Klausur		
Examination duration and scale	60 min		
Lecturer	Prof. Günter Rombach		
Language	DE		
Cycle	WiSe		
Content	 application and advantages and disadvantages of precast concrete structures basics of design - precast element production - construction - tolerances elements of a warehouse design of a beam - joints design of D-regions: half joints, corbels, openings slab types - walls - facades footings: pocket and block foundations joints - connections shear design of the interface between concrete cast at different times unreinforced concrete structures 		
Literature	 Bachmann H., Steinle A.; Hahn V.: Bauen mit Betonfertigteilen. Betonkalender 20 Teil I, Verlag Ernst & Sohn, Berlin Bindseil P.: Stahlbetonfertigteile. Werner Verlag, 1998 FIP: FIP Handbuch für Planung und Entwerfen von Fertigteilbauten (siehe Zeitscher Beton- und Fertigteiltechnik ab 3/1996) Bergmeister K.: Konstruieren von Fertigteilen. Betonkalender 2005 Teil 2, S. 163-24 Reineck KH.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 2, S. 241-296 Graubner CA. et. al.: Bemessung von Fertigteilen nach DIN 1045-1. Betonkaler 2005 Teil 2, S. 297-374 Broschüren der Fachvereinigung Deutscher Betonfertigteilbau e.V. siehe: www.fdb-fertigteilbau.de www.systembauweise.de 		

Course L0597: Design of Prefabricated Concrete Structures		
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 scale	Siehe korrespondierende Vorlesung	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1634: Forum I - Geotechnics and Construction Management		
Тур	Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Examination Form		
Examination duration and scale	30 min	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	WiSe	
Content	Lectures about projects and issues with practical and scientific relevance.	
Literature		

Course L1635: Forum II - Geotechnics and Construction Management		
Тур	Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
	Mündliche Prüfung	
Examination duration and scale	30 min	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	SoSe	
Content	Lectures about projects and issues with practical and scientific relevance.	
Literature		

Course L1151: Timber Structures		
Тур	Seminar	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form		
Examination duration and scale	90 min	
Lecturer	Prof. Torsten Faber	
Language	DE	
Cycle	WiSe	
Content		
Literature		



Course L1152: Glass Structures		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form		
Examination duration and scale	60 min	
Lecturer	Marvin Matzik	
Language	DE	
Cycle	WiSe	
Content	Glass structures - Introduction of the material glass (production, refinement, material characteristic) - design of facades - facade types - static calculation of glazing - static calculation of facades - load bearing behavior of glazing (plate or membrane stiffness) - vertical / horizontal glazing with safety-related requirements - glass structures - fire safety of glass facades - construction physics of facades and glazing	
Literature		
Eito. atai c		

Course L1447: Glass Structures		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Examination Form		
Examination duration and scale	60 min	
Lecturer	Marvin Matzik	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1905: Wind turbine design		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
	Mündliche Prüfung	
Examination duration and scale	30 min	
Lecturer	Dr. Jörn Scheller	
Language	DE	
Cycle	SoSe	
Content		
Literature		



Module M0965: S	Study Work Structural Engineering		
Courses			
Title	Typ Hrs/wk CP		
Module Responsible	Dozenten des SD B		
Admission Requirements	INONE		
Recommended Previous Knowledge	Subjects of the Structural Engineering specialisation.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
	The students are able to demonstrate their detailed knowledge in the field of structural and construction engineering. They can exemplify the state of technology and application and discuss critically in the context of actual problems and general conditions of science and society.		
Knowledge	The students can develop solving strategies and approaches for fundamental and practical problems in structural and construction engineering. They may apply theory based procedures and integrate safety-related, ecological, ethical, and economic view points of science and society.		
	Scientific work techniques that are used can be described and critically reviewed.		
Skills	The students are able to independently select methods for the project work and to justify this choice. They can explain how these methods relate to the field of work and how the context of application has to be adjusted. General findings and further developments may essentially be outlined.		
Personal Competence			
Social Competence	The students are able to condense the relevance and the structure of the project work, the		
Autonomy	The students are capable of independently planning and documenting the work steps and procedures while considering the given deadlines. This includes the ability to accurately procure the newest scientific information. Furthermore, they can obtain feedback from experts with regard to the progress of the work, and to accomplish results on the state of the art in science and technology.		
Workload in Hours	Independent Study Time 180, Study Time in Lecture 0		
Credit points	6		
Studienleistung	None		
Examination	Study work		
Examination duration and scale	Isee ESP()		
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Compulsory		



Module M0997: S	tructural Analysis - Selected	I Topics		
Courses				
Title		Тур	Hrs/wk	CP
Plates and Shells (L1199)		Lecture	2	2
Nonlinear Analysis of Fran		Lecture	2	2
Nonlinear Analysis of Fran	ne Structure (L1201)	Recitation Section (large)	2	2
Module Responsible	Prof. Uwe Starossek			
Admission Requirements	None			
Recommended Previous Knowledge	Mechanics I/II, Mathematics I/II, Differen	ntial Equations I		
Educational Objectives	After taking part successfully, students	have reached the following lea	rning resul	lts
Professional				
Competence				
Knowledge	After successful completion of this mostructural analysis.	dule, students can explain sele	ected elem	ents of higher
Skills	After successful completion of this most the applicability of the presented methods for performing structure.	hods of advanced structural ar		
Personal				
Competence				
Social Competence	 participate in subject-specific and interdisciplinary discussions, defend their own work results in front of others promote the scientific development of colleagues Furthermore, they can give and accept professional constructive criticism 			
Autonomy	The students have the opportunity to vo	oluntarily and independently wo	ork homew	ork problems.
Workload in Hours	Independent Study Time 96, Study Tim	ne in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	135 min			
Assignment for the Following Curricula	Civil Engineering: Specialisation Struc Civil Engineering: Specialisation Geote Civil Engineering: Specialisation Coas	echnical Engineering: Elective	Compulsor	у



Tım	Lecture	
Hrs/wk		
CP		
	Independent Study Time 32, Study Time in Lecture 28	
	Dr. Jürgen Priebe	
Language		
Cycle		
Content	Theory of plates loaded in-plane Governing equations (equilibrium, kinematics, constitutive law) Differential equation Airy stress function Plane stress / plane strain Structural behaviour of plates loaded in-plane Theory of plates in bending Governing equations (equilibrium, kinematics, constitutive law) Differential equation Navier solution / Fourier series expansion Approximation procedures Structural behaviour of plates in bending Shell theory Phenomenona of the structural behaviour of shells Membrane and bending theory Equilibrium equations of shells of revolution Stress resultants and deformations of the spherical shell, the half spherical shell, at the cylindrical shell Stability problems (overview) Plate buckling Shell buckling	
Literature	 Basar, Y.: Krätzig, W.B. (1985): Mechanik der Flächentragwerke. Vieweg-Verlagerunschweig, Wiesbaden Girkmann, K. (1963): Flächentragwerke, Springer Verlag, Wien, 1963, unverändert Nachdruck 1986 Zienkiewicz, O.C. (1977): The Finite Element Method in Enginieering Science McGraw-Hill, London 	



Course L1200: Nonlinear Analysis of Frame Structure		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	WiSe	
Content	-Types of nonlinearity -relevance of nonlinear effects on structural analysis -comparison and classification of 1st order theory, 2nd order theory and 3rd order theory with regard to the coverage of geometric nonlinearity -fundamentals of 2nd order elasticity theory for frame structures -application of 2nd order elasticity theory using finite elements: common displacement method fundamentals of analytical application of 2nd order elasticity theory: derivation and solution of differential equation -structurally applied methods of analytical application of 2nd order elasticity theory: common displacement method using analytical stiffness matrix, slope-deflection method for sway and non-sway frame structures, consideration of imperfections 1st order plastic hinge theory	
Literature	Rothert, H.; Gensichen, V. (1987): Nichtlineare Stabstatik. Springer Verlag, Berlin	

Course L1201: Nonlinear Analysis of Frame Structure		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Specialization Water and Traffic

Module M0964: Structures in Foundation and Hydraulic Engineering				
Courses				
Title Steel Structures in Foundard Underground Construction Underground Construction		Typ Lecture Lecture Recitation Section (large)	Hrs/wk 2 1	CP 3 2 1
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge		Geotechnics I-II		
Educational Objectives	After taking part successfully, students have r	eached the following lea	rning result	ts
Professional				
Competence				
Knowledge	Knowledge of different tunnel construction types as well as special methods and techniques of subsoil construction. The students get deeper knowledge of steel and ground engineering as well as constructions knowledge concerning quay walls. Futhermore, the students get all the neccessary knowledge to design singular construction elements for sheet pile walls and they know how to choose the right construction elements depending on the influencing conditions.			
Skills	Basic knowledge of tunnel design as well as practical skills in structural tunnel analysis. Furthermore, the students are able to dimension sheet pile wall construction regarding all construction elements, to choose the suitable construction elements with respect to the influencing conditions, to design all kinds of sheet pile walls (wave sheet pile walls and combined sheet pile walls) and to dimension all construction elements and connections.			
Personal				
Competence			(
	Capacity for teamwork concerning project ma Promotion of independent and creative work	-		oroico
-	Independent Study Time 124, Study Time in L		a uesiyii ex	CIUISE.
Credit points		Lecture 30		
Studienleistung				
-	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following Curricula		al Engineering: Compuls gineering: Compulsory Traffic: Elective Compuls	ory	ring: Elective



Course L1146: Steel Structures in Foundation and Hydraulic Engineering			
Тур	Lecture		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Frank Feindt		
Language	DE		
Cycle	WiSe		
Content	Design of a sheet pile wall, design of a combined sheet pile wall, piles, walings, connections, fatigue		
Literature	EAU 2012, EA-Pfähle, EAB		

Course L0707: Underg	round Constructions
Тур	Lecture
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Marius Milatz
Language	DE
Cycle	WiSe
Content	 Definitions Historical development in tunneling Geology for tunneling Hard rock tunneling (construction composite and machines) Tunnelung in temporarly stable soil with conventional construction methods Tunneling in soft soils (form of supports, shield types, compressed air application) Pipe jacking Tunnel Lining, tunnel supporting structures Calculation approaches for supporting structures in shield-driven tunnels Surveying for tunneling Safety requirements Construction Contract Literature and sources
Literature	 Vorlesung/Übung s. www.tu-harburg.de/gbt

Course L1811: Underground Constructions		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Marius Milatz	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0595: E	xamination of Mate	rials, Structura	I Condition and I	Damages	
Courses					
	Structural Condition and Dama Structural Condition and Dama	ages (L0260)	Typ Lecture Recitation Section (small)	Hrs/wk 4 1	CP 4 2
Module Responsible	Prof. Frank Schmidt-Döhl				
Admission Requirements	None				
	Basic knowledge about b Building Materials and Bu		material science, for	example by	the module
Educational Objectives	After taking part successfu	lly, students have re	ached the following lea	rning results	;
Professional Competence					
Knowledge	The students are able to products in Germany. The are usable and know the I	y know which metho	ds for the testing of bui	Iding materi	al properties
Skills	The students are able to responsibly discover the rules for trading and using of building products in Germany. They are able to chose suitable methods for the testing and inspection of construction products, the examination of damages and the examination of the structural conditions of buildings. They are able to conclude from symptons to the cause of damages. They are able to describe an examination in form of a test report or expert opinion.				
Personal Competence					
Social Competence	The students can describe the different roles of manufacturers as well as testing, supervisory and certification bodies within the framework of material testing. They can describe the different roles of the participants in legal proceedings.				
Autonomy	The students are able to knowledge of a very exten		nd the operation steps	s to learn th	ne specialist
Workload in Hours	Independent Study Time 1	10, Study Time in Le	ecture 70		
Credit points					
Studienleistung					
Examination	Written exam				
Examination duration and scale	120 min				
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Materials Science: Specialisation Engineering Materials: Elective Compulsory				



Course L0260: Examir	ourse L0260: Examination of Materials, Structural Condition and Damages		
Тур	Lecture		
Hrs/wk	4		
СР	4		
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56		
Lecturer	Prof. Frank Schmidt-Döhl		
Language	DE		
Cycle	WiSe		
Content	Materials testing and marking process of construction products, testing methods for building materials and structures, testing reports and expert opinions, describing the condition of a structure, from symptons to the cause of damages		
Literature	Frank Schmidt-Döhl: Materialprüfung im Bauwesen. Fraunhofer irb-Verlag, Stuttgart, 2013.		

Course L0261: Examination of Materials, Structural Condition and Damages		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses				
Title Integrated Transportation	Planning (I 1068)	Typ Project-/problem-based Learning	Hrs/wk 4	CP 6
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous Knowledge	some knowledge of transport planning, e.g. thro Planning and Traffic Engineerin	ough taking the underg	graduate cl	ass "Transpo
Educational Objectives	After taking part successfully, students have rea	ached the following lea	rning resu	lts
Professional Competence				
Knowledge	 describe interdependencies bet transportation/mobility behaviour explain and evaluate the social, ecolog use policy measures. relate current issues in the area of in opinion on them. 	ical and economic effe	cts of trans	
Skills	Students are able to: quantify important parameters, which in comprehensively examine a pre-defining studies perspective and document conventions.	ed or self-selected top	oic from a	transportation
Personal Competence				
Social Competence	 Students are able to: provide feedback on topical contents ar constructively handle feedback on their produce results in group work and docu 	own work.		
Autonomy	Students are able to: assess potential consequences of their independently plan working on a preknowledge and use appropriate means	e-defined project topic		he necessai
	Independent Study Time 124, Study Time in Le	ecture 56		
Credit points				
Studienleistung				



Examination	Written elaboration		
Examination duration and scale	written assignment with presentation during the semester		
Assignment for the	H odistics intrastructure and Mobility. Specialisation intrastructure and Mobility. Electivel		

Course L1068: Integra	ted Transportation Planning	
Тур	Project-/problem-based Learning	
Hrs/wk	4	
СР	6	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß	
Language	DE	
Cycle	WiSe	
Content	The course will provide students with an understanding of interdependencies between landuse and transportation. Specific topics include a.o.: • interactions between transport and the environment and consequent limitations • characteristics of integrated planning • complex planning processes • interdependencies of location choice and mobility behaviour • transport and land-use policies • project on current issues in transportation studies	
Literature	Kutter, Eckhard (2005) Entwicklung innovativer Verkehrsstrategien für die mobile Gesellschaft. Erich Schmidt Verlag. Berlin. Bracher, Tilman u. a. (Hrsg.) (68. Ergänzung 2013) Handbuch der kommunalen Verkehrsplanung. Herbert Wichmann Verlag. Berlin, Offenbach. (Loseblattsammlung mit kontinuierlichen Ergänzungen)	



Module M0801: V	Vater Resources and -Supply			
Courses				
Title Chemistry of Drinking Wa Chemistry of Drinking Wa Water Resource Manager Water Resource Manager	ter Treatment (L0312) ment (L0402)	Typ Lecture Recitation Section (large) Lecture Recitation Section (small)	2	CP 1 2 2 1
Module Responsible	Prof. Mathias Ernst			
Admission Requirements				
Recommended Previous Knowledge	Knowledge of water management and the key	processes involved in v	water treatr	ment.
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning resul	ts
Professional Competence				
Knowledge	Students will be able to outline key areas of conflict in water management, as well as their mutual dependence for sustainable water supply. They will understand relevant economic, environmental and social factors. Students will be able to explain and outline the organisational structures of water companies. They will be able to explain the available water treatment processes and the scope of their application.			
Skills	Students will be able to assess complex problems in drinking water production and establish solutions involving water management and technical measures. They will be able to assess the evaluation methods that can be used for this. Students will be able to carry out chemical calculations for selected treatment processes and apply generally accepted technical rules and standards to these processes.			
Personal Competence				
Social Competence	Working in a diverse group of specialists, students will be able to develop and document complex solutions for the management and treatment of drinking water. They will be able to take an appropriate professional position, for example representing user interests. They will be able to develop joint solutions in teams of diverse experts and present these solutions to others.			
Autonomy	Students will be in a position to work on a sub	Students will be in a position to work on a subject independently and present on this subject.		
Workload in Hours	Independent Study Time 96, Study Time in Le	cture 84		
Credit points	,			
Studienleistung				
	Written exam			
Examination duration and scale	60 min (chemistry) + presentation			
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Compulsory Energy and Environmental Engineering: Specialisation Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory			



Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0311: Chemistry of Drinking Water Treatment			
Тур	Lecture		
Hrs/wk	2		
СР	1		
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28		
Lecturer	Dr. Klaus Johannsen		
Language	DE		
Cycle	WiSe		
	The topic of this course is water chemistry with respect to drinking water treatment and water distribution		
	Major topics are solubility of gases, carbonic acid system and calcium carbonate, blending, softening, redox processes, materials and legal requirements on drinking water treatment. Focus is put on generally accepted rules of technology (DVGW- and DIN-standards).		
Content	Special emphasis is put on calculations using realistic analysis data (e.g. calculation of pH or calcium carbonate dissolution potential) in exercises. Students can get a feedback and gain extra points for exam by solving problems for homework.		
	Knowledge of drinking water treatment processes is vital for this lecture. Therefore the most important processes are explained coordinated with the course "Water resources management" in the beginning of the semester.		
	MHW (rev. by Crittenden, J. et al.): Water treatment principles and design. John Wiley &		
	Sons, Hoboken, 2005.		
	Stumm, W., Morgan, J.J.: Aquatic chemistry. John Wiley & Sons, New York, 1996.		
Literature	DVGW (Hrsg.): Wasseraufbereitung - Grundlagen und Verfahren. Oldenbourg Industrie Verlag, München, 2004.		
	Jensen, J. N. : A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.		

Course L0312: Chemistry of Drinking Water Treatment		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Dr. Klaus Johannsen	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0402: Water	Resource Management
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Mathias Ernst
Language	DE
Cycle	WiSe
Content	The lecture provides comprehensive knowledge on interaction of water ressource management and drinking water supply. Content overview: • Current situation of global water resources - User and Stakeholder conflicts - Wasserressourcenmanagement in urbane Gebieten - Rechtliche Aspekte, Organisationsformen Trinkwasserversorgungsunternehmen. - Ökobilanzierung, Benchmarking in der Wasserversorgung
Literature	 Aktuelle UN World Water Development Reports Branchenbild der deutschen Wasserwirtschaft, VKU (2011) Aktuelle Artikel wissenschaftlicher Zeitschriften Ppt der Vorlesung

Course L0403: Water Resource Management		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Mathias Ernst	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0830: E	Environmental Protection and Ma	anagement		
Courses				
Title Integrated Pollution Control Health, Safety and Enviro	ol (L0502) nmental Management (L0387)	Typ Lecture Lecture	Hrs/wk 2 2	CP 2 3
Health, Safety and Enviro	nmental Management (L0388)	Recitation Section (small)	1	1
Module Responsible	! !			
Admission Requirements	INONA			
Recommended Previous Knowledge	The state of the s	rironmental Legislation		(end-of-pipe
Educational Objectives	Latter taking part circocctully, ctudente have	reached the following lea	rning resu	lts
Professional Competence				
Knowledge	The students are able to describe the basics of regulations, economic instruments, voluntary initiatives, fundamentals of HSE legislation ISO 14001, EMAS and Responsible Care ISO 14001 requirements. They can analyse and discuss industrial processes, substance cycles and approaches from end-of-pipe technology to eco-efficiency and eco-effectiveness showing their sound knowledge of complex industry related problems. They are able to judge environmental issues and to widely consider, apply or carry out innovative technical solutions remediation measures and further interventions as well as conceptual problem solving approaches in the full range of problems in different industrial sectors.			
Skills	Students are able to assess current probl protection. They can consider the best avail actions in a company- or branch-specific co technical, administrative and legislative level	able techniques and to plantext. By this means they	an and su	ggest concret
Personal Competence				
Social Competence	The students can work together in internatio	nal groups.		
Autonomy	Students are able to organize their work flow to prepare themselves for presentations and contributions to the discussions. They can acquire appropriate knowledge by making enquiries independently.			
Workload in Hours	Independent Study Time 110, Study Time in	Lecture 70		
Credit points	6			
Studienleistung				
	Written exam			
Examination duration and scale	I MIT MIN			



Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Core qualification: Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Energy: Elective Compulsory Product Development, Materials and Production: Specialisation Product Development: Elective Compulsory Product Development, Materials and Production: Specialisation Production: Elective Compulsory Product Development, Materials and Production: Specialisation Materials: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory
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Course L0502: Integra	ted Pollution Control
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 The Regulatory Framework Pollution & Impacts, Characteristics of Pollutants Approaches of Integrated Pollution Control Sevilla Process, Best Available Technologies & BREF Documents Case Studies: paper industry, cement industry, automotive industry Field Trip
Literature	Förstner, Ulrich (1998): Integrated Pollution Control, Springer-Verlag Berlin Heidelberg, ISBN 978-3-642-80313-0 Shen, Thomas T. (1999): Industrial Pollution Prevention, Springer-Verlag Berlin Heidelberg, ISBN 978-3-540-65208-3



Course L0387: Health,	Safety and Environmental Management		
Тур	Lecture		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Hans-Joachim Nau		
Language	EN		
Cycle	WiSe		
Content	 Objectives of and benefit from HSE management From dilution and end-of-pipe technology to eco-efficiency and eco-effectiveness Behaviour control: regulations, economic instruments and voluntary initiatives Fundamentals of HSE legislation ISO 14001, EMAS and Responsible Care ISO 14001 requirements Environmental performance evaluation Risk management: hazard, risk and safety Health and safety at the workplace Crisis management 		
Literature	C. Stephan: Industrial Health, Safety and Environmental Management, MV-Verlag, Münster 2007/2012 (can be found in the library under GTG 315) Exercises can be downloaded from StudIP		

Course L0388: Health, Safety and Environmental Management		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Hans-Joachim Nau	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses				
Title		Tun	Hrs/wk	СР
Title Biological Wastewater Tre	eatment (L0517)	Typ Lecture	2	3
Air Pollution Abatement (L		Lecture	2	3
Module Responsible	Dr. Ernst-Ulrich Hartge			
Admission Requirements	INone			
	Basic knowledge of biology and	d chemistry		
Recommended Previous Knowledge	basic knowledge of solids proce	ess engineering and separation	technology	
Educational Objectives	I Atter taking part successfully st	udents have reached the followi	ing learning resu	Its
Professional Competence				
	After successful completion of the	he module students are able to		
Knowledge	characterize waste watediscuss legal regulation	ogical processes for waste water er and sewage sludge s in the area of emissions and a t processes and to define their a	ir quality	n
Skills	: I	cesss steps for the biological wa cleaning of off-gases depending		
	the gases	ordaning or on gases depending	y on the penatam	o oomamou i
Personal				
Competence	;			
Social Competence	<u> </u>			
Autonomy	1	North Time in Leature FC		
Credit points	Independent Study Time 124, S	study Time in Lecture 56		
Studienleistung	ļ.			
	Written exam			
Examination duration	90 min			
and scale				
Assignment for the Following Curricula	Bioprocess Engineering: Spe Compulsory Chemical and Bioprocess Engi Compulsory Energy and Environmental Eng Compulsory Environmental Engineering: Sp International Management and Engineering: Elective Compulsory Joint European Master in Env	on Water and Traffic: Elective Concialisation A - General Bioperialisation General Biopering: Specialisation General Biopering: Specialisation Environmental Studies - Cities and Energy:	Process Engineer I Process Engine Inmental Engine Elective Compulation	ering: Electiv ering: Electiv sory Environmenta
	Water: Elective Compulsory	sation Bioenergy Systems: Electi		



Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory
Process Engineering: Specialisation Process Engineering: Elective Compulsory
Water and Environmental Engineering: Specialisation Water: Elective Compulsory
Water and Environmental Engineering: Specialisation Environment: Compulsory
Water and Environmental Engineering: Specialisation Cities: Compulsory

Typ	Lecture
Hrs/wk	
CP	
	Independent Study Time 62, Study Time in Lecture 28
	Dr. Joachim Behrendt
Language	DE/EN
Cycle	WiSe
Content	Charaterisation of Wastewater Metobolism of Microorganisms Kinetic of mirobiotic processes Calculation of bioreactor for wastewater treatment Concepts of Wastewater treatment Design of WWTP Excursion to a WWTP Biofilms Biofim Reactors Anaerobic Wastewater and sldge treatment resources oriented sanitation technology Future challenges of wastewater treatment
	Siedlungswasserwirtschaft: mit 84 Tabellen ISBN: 3540343296 (Gb.) URL: http://www.gbv.de/dms/bs/toc/516261924.pdf UR http://deposit.d-nb.de/cgi-bin/dokserv?id=2842122&prov=M&dok_var=1&dok_ext=htm Berlin [u.a.]: Springer, 2007 TUB_HH_Katalog Henze, Mogens Wastewater treatment: biological and chemical processes ISBN: 3540422285 (Pp.) Berlin [u.a.]: Springer, 2002 TUB_HH_Katalog Imhoff, Karl (Imhoff, Klaus R.;) Taschenbuch der Stadtentwässerung: mit 10 Tafeln ISBN: 3486263331 ((Gb.)) München [u.a.]: Oldenbourg, 1999 TUB_HH_Katalog Lange, Jörg (Otterpohl, Ralf; Steger-Hartmann, Thomas;) Abwasser: Handbuch zu einer zukunftsfähigen Wasserwirtschaft ISBN: 3980350215 (kart.) UR http://www.gbv.de/du/services/agi/52567E5D44DA0809C12570220050BF25/00000070033 Donaueschingen-Pfohren: Mall-Beton-Verl., 2000 TUB_HH_Katalog Mudrack, Klaus (Kunst, Sabine;) Biologie der Abwasserreinigung: 18 Tabellen ISBN: 382741427X UR http://www.gbv.de/du/services/agi/94B581161B6EC747C1256E3F005A8143/42000011490 Heidelberg [u.a.]: Spektrum, Akad. Verl., 2003 TUB_HH_Katalog



Literature | ISBN: 0070418780 (alk. paper) ISBN: 0071122508 (ISE (*pbk))

Boston [u.a.]: McGraw-Hill, 2003

TUB_HH_Katalog

Henze, Mogens

Activated sludge models ASM1, ASM2, ASM2d and ASM3

ISBN: 1900222248 London : IWA Publ., 2002 TUB_HH_Katalog

Kunz, Peter

Umwelt-Bioverfahrenstechnik

Vieweg, 1992

Bauhaus-Universität., Arbeitsgruppe Weiterbildendes Studium Wasser und Umwelt

(Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall, ;)

Abwasserbehandlung: Gewässerbelastung, Bemessungsgrundlagen, Mechanische Verfahren, Biologische Verfahren, Reststoffe aus der Abwasserbehandlung, Kleinkläranlagen ISBN: 3860682725 URL: http://www.gbv.de/dms/weimar/toc/513989765_toc.pdf URL:

http://www.gbv.de/dms/weimar/abs/513989765_abs.pdf

Weimar: Universitätsverl, 2006

TUB HH Katalog

Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall

DWA-Regelwerk Hennef : DWA, 2004 TUB_HH_Katalog

Wiesmann, Udo (Choi, In Su; Dombrowski, Eva-Maria;) Fundamentals of biological wastewater treatment

ISBN: 3527312196 (Gb.) URL: http://deposit.ddb.de/cgi-bin/dokserv?

id=2774611&prov=M&dok_var=1&dok_ext=htm

Weinheim: WILEY-VCH, 2007

TUB HH Katalog

Course L0203: Air Pollution Abatement		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Ernst-Ulrich Hartge	
Language	EN	
Cycle	WiSe	
Content	In the lecture methods for the reduction of emissions from industrial plants are treated. At the beginning a short survey of the different forms of air pollutants is given. In the second part physical principals for the removal of particulate and gaseous pollutants form flue gases are treated. Industrial applications of these principles are demonstrated with examples showing the removal of specific compounds, e.g. sulfur or mercury from flue gases of incinerators.	
Literature	Handbook of air pollution prevention and control, Nicholas P. Cheremisinoff Amsterdam [u.a.]: Butterworth-Heinemann, 2002 Atmospheric pollution: history, science, and regulation, Mark Zachary Jacobson Cambridge [u.a.]: Cambridge Univ. Press, 2002 Air pollution control technology handbook, Karl B. Schnelle Boca Raton [u.a.]: CRC Press, c 2002 Air pollution, Jeremy Colls 2. ed London [u.a.]: Spon, 2002	



Madula M000C. F	Siele wy Coele wy and (Oh a mai adum.		
Module MU826: E	Biology, Geology and C	Snemistry		
Courses				
Title		Тур	Hrs/wk	СР
Biology (L1428)		Lecture	2	2
Geology and Soil Science	,	Lecture	2	1
Environmental Analysis (I		Lecture	2	3
Module Responsible	Dr. Dorothea Rechtenbach			
Admission Requirements	INIONO			
Recommended Previous Knowledge		ganic chemistry and biology (know	rledge acquired	at school)
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	With the completion of this module students acquire profound knowledge of the geo- and pedosphere, biogeochemical processes and the fate of migrating compounds in soil and groundwater. They learn about methods to investigate sites for different use.			
Skills	With the completion of this module students can apply the acquired theoretical knowledge to model sites and assess the situation technically and conceptually. They are able to draw comparisons on different investigation strategies and techniques. Model projects can be devised and treated.			
Personal Competence				
Social Competence	Students can discuss technic	cal and scientific tasks within a	seminar subjec	t specific and
Autonomy		exploit sources, acquire the partic	cular knowledge	of the subjec
Workload in Hours	Independent Study Time 96, S	Study Time in Lecture 84		
Credit points	6		_	
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	2 Std. 15 Min.			
Assignment for the	Civil Engineering: Specialisati	ion Water and Traffic: Elective Con	npulsory	

Following Curricula Water and Environmental Engineering: Core qualification: Compulsory



Course L1428: Biology	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Anna Krüger
Language	DE
Cycle	WiSe
Content	
Literature	Umweltmikrobiologie, Reineke, W. und Schlömann, M. (2015) 2. Aufl., Springer Spektrum Verlag

Course L0903: Geolog	y and Soil Science
Тур	Lecture
Hrs/wk	2
СР	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth, Sonja Schröter
Language	DE
Cycle	WiSe
Content	Geology: formation of the Earth, plate tectonics, macroscopic rock identification, introduction to Earth history, introduction to halokinesis. Soil science: soil use and function in ecosystems, faktors and processes of soil formation, mineral and organic components, surface types and properties, retention of nutrients and pollutants, hazards from faulty land use, erosion, salinization, and contamination, measures to preserve soils
Literature	 R. Vinx (2011): "Gesteinsbestimmung im Gelände" H. Bahlburg & C. Breitkreutz (2012): "Grundlagen der Geologie", TUB Signatur GWB-318 R. Walter (2003): "Ergeschichte" TUB Signatur: 2816-1769 F.Scheffer und P. Schachtschabel (2002): "Lehrbuch der Bodenkunde" TUB Signatur AGG-308 W.E.H. Blum (2007): "Bodenkunde in Stichworten" TUB Signatur AGG-317

Course L0354: Environmental Analysis		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Dorothea Rechtenbach, Dr. Henning Mangels	
Language	EN	
Cycle	WiSe	
	Introduction	
	Sampling in different environmental compartments, sample transportation, sample storage	
	Sample preparation	



Photometry

Wastewater analysis

Introduction into chromatography

Content Gas chromatography

HPLC

Mass spectrometry

Optical emission spectrometry

Atom absorption spectrometry

Quality assurance in environmental analysis

Roger Reeve, Introduction to Environmental Analysis, John Wiley & Sons Ltd., 2002 (TUB: USD-728)

Pradyot Patnaik, Handbook of environmental analysis: chemical pollutants in air, water, soil, and solid wastes, CRC Press, Boca Raton, 2010 (TUB: USD-716)

Chunlong Zhang, Fundamentals of Environmental Sampling and Analysis, John Wiley & Sons Ltd., Hoboken, New Jersey, 2007 (TUB: USD-741)

Miroslav Radojević, Vladimir N. Bashkin, Practical Environmental Analysis RSC Publ., Cambridge, 2006 (TUB: USD-720)

Werner Funk, Vera Dammann, Gerhild Donnevert, Sarah lannelli (Translator), Eric lannelli (Translator), Quality Assurance in Analytical Chemistry: Applications in Environmental, Food and Materials Analysis, Biotechnology, and Medical Engineering, 2nd Edition, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2007 (TUB: CHF-350)

STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, 21st Edition, Andrew D. Eaton, Leonore S. Clesceri, Eugene W. Rice, and Arnold E. Greenberg. editors, 2005 (TUB:CHF-428)

K. Robards, P. R. Haddad, P. E. Jackson, Principles and Practice of Literature Modern Chromatographic Methods, Academic Press

- G. Schwedt, Chromatographische Trennmethoden, Thieme Verlag
- H. M. McNair, J. M. Miller, Basic Gas Chromatography, Wiley
- W. Gottwald, GC für Anwender, VCH
- B. A. Bidlingmeyer, Practical HPLC Methodology and Applications, Wiley
- K. K. Unger, Handbuch der HPLC, GIT Verlag
- G. Aced, H. J. Möckel, Liquidchromatographie, VCH

Charles B. Boss and Kenneth J. Fredeen, Concepts, Instrumentation and Techniques in Inductively Coupled Plasma Optical Emission Spectrometry

Perkin-Elmer Corporation 1997, On-line available at:

http://files.instrument.com.cn/bbs/upfile/2006291448.pdf

Atomic absorption spectrometry: theory, design and applications, ed. by S. J. Haswell 1991 (TUB: 2727-5614)

Society Chemistry, Atomic absorption of spectometry (http://www.kau.edu.sa/Files/130002/Files/6785 AAs.pdf)





Module M1403: C	Construction and Si	mulation of Se	werage Systems	;	
Courses					
Title	Sec. (C. 16	1000)	Тур	Hrs/wk	CP
Simulation of sewerage sy	ion of urban sewer systems (L /stems (L2006)	_1998)	Seminar Seminar	3 3	3
Module Responsible					
Admission Requirements	<u> </u>				
Recommended Previous Knowledge	Soil mechanics and	d foundation engine		ement	
Educational Objectives	After taking part successfu	Illy, students have re	eached the following lea	arning resul	ts
Professional					
Competence	! !				
Knowledge		form system and we titatively. Furthermon ased on the St. Ven	eak point analyzes. In a re, they have the knowle ant equations.	ddition, the edge to con	y can analyze nprehend flow
	Students have knowledge damage are investigated sewer systems is acquired	and the knowledge	-	-	
Skills	The students can simulate different run-off events in sewer systems and are able to dimension the sewer systems accordingly. Moreover, they can determine suitable construction materials and static requirements for different cases of application.				
Personal Competence					
Social Competence	Students are able to apply	the acquired skills i	n a team and can impa	rt this know	ledge.
Autonomy	Students can solve problems in the field of wastewater systems independently, concerning in particular dimensioning and simulation of sewer systems. Furthermore, they are able to present and justify their solutions.				
Workload in Hours	Independent Study Time 9	96, Study Time in Le	cture 84		
Credit points	6				
Studienleistung	Compulsory Bonus No 20 %	Form Presentation	Description	on	
Examination	Written elaboration				
Examination duration and scale	nach Absprache				
Assignment for the Following Curricula	Civil Engineering: Special Water and Environmental Water and Environmental	Engineering: Specia	alisation Water: Compu	-	mpulsory

Course L1998: Construction and renovation of urban sewer systems	
Typ Seminar	



Verlag, Berlin, 1997 Arbeitsblatt DWA-A 143 Entwässerungssystemen Gebäuden, Teil 1: Planung von Sanierungsmaßnahme Arbeitsblatt DWA-A 143 Entwässerungssystemen Gebäuden Teil 2: Statisc Sanierung von Abwasse kanälen mit Lining und Juli 2015 D I NEN 752 Entwässerungssysteme Gebäuden - Kanalmanage Zeitschrift 3R, Fachzeitsc	
Lecturer Language EN Cycle WiSe The lecture focusses on construction and renovation of urban sewer pipelit Construction: Pipe materials, types and joint technology Open trenches Trenchless technologies Pipe Statics: Content Design of sewers according to ATV A 127 Earth pressure on pipes, pipe deformation, cutting forces Comparison with other international calculation approaches Renovation: Failure case study Overview on the different renovation technologies Liner design according to DWA-A 143 Nr. Titel ATV A 127, Abwassertech e.V., Arbeitsblatt A 127, Re Abfall, Vertrieb: GFA, DK 6 2000 DIN EN 1610, Verlegung Abwasserleitungen und Verlag, Berlin, 1997 Arbeitsblatt DWA-A 143 3 Gebäuden, Teil 1: Planung von Sanierungsmaßnahm Arbeitsblatt DWA-A 143 Entwässerungssystemen Gebäuden Teil 2: Statisc Sanierung von Abwass kanälen mit Lining und Juli 2015 D I N EN 752 Entwässerungssystemen Gebäuden Kanalmanage Gebäuden Kanalmanage Zeitschrift 3R, Fachzeitsci	
Language EN Cycle WiSe The lecture focusses on construction and renovation of urban sewer pipelis Construction: • Pipe materials, types and joint technology • Open trenches • Trenchless technologies Pipe Statics: Content • Design of sewers according to ATV A 127 • Earth pressure on pipes, pipe deformation, cutting forces • Comparison with other international calculation approaches Renovation: • Failure case study • Overview on the different renovation technologies • Liner design according to DWA-A 143 Nr. Titel ATV A 127, Abwassertech e.V., Arbeitsblatt A 127, Re Abfall, Vertrieb: GFA, DK 6 2000 DIN EN 1610, Verlegung Abwasserfeitungen und Verlag, Berlin, 1997 Arbeitsblatt DWA-A 143 1 Entwässerungssystemen Gebäuden, Teil 1: Planung von Sanierungsmaßnahme Arbeitsblatt DWA-A 144 Entwässerungssystemen Gebäuden Teil 2: Statisc Sanierung von Abwasse kanälen mit Lining und Juli 2015 D I N EN 752 Entwässerungssystemen Gebäuden - Kanalmanage Gebäuden - Kanalmanage Zeitschrift 3R, Fachzeitsci	
The lecture focusses on construction and renovation of urban sewer pipelis Construction: Pipe materials, types and joint technology Open trenches Trenchless technologies Pipe Statics: Design of sewers according to ATV A 127 Earth pressure on pipes, pipe deformation, cutting forces Comparison with other international calculation approaches Renovation: Failure case study Overview on the different renovation technologies Liner design according to DWA-A 143 Nr. Titel ATV A 127, Abwassertech e.V., Arbeitsblatt A 127, Re Abfall, Vertrieb: GFA, DK 6 2000 DIN EN 1610, Verlegung Abwasserleitungen und Verlag, Berlin, 1997 Arbeitsblatt DWA-A 143 3 Gebäuden, Teil 1: Planung von Sanierungsmaßnahmi Arbeitsblatt DWA-A 143 Entwässerungssystemen Gebäuden Teil 2: Statisc Sanierung von Abwasss kanälen mit Lining und Juli 2015 D I N EN 752 Entwässerungssysterung Gebäuden - Kanalmanage Zeitschrift 3R, Fachzeitsci	
Construction: Pipe materials, types and joint technology Open trenches Trenchless technologies Pipe Statics: Design of sewers according to ATV A 127 Earth pressure on pipes, pipe deformation, cutting forces Comparison with other international calculation approaches Renovation: Failure case study Overview on the different renovation technologies Liner design according to DWA-A 143 Nr. Titel ATV A 127, Abwassertech e.V., Arbeitsblatt A 127, Re Abfall, Vertrieb: GFA, DK 6 2000 DIN EN 1610, Verlegung Abwasserleitungen und Verlag, Berlin, 1997 Arbeitsblatt DWA-A 143 Tentwässerungssystemen Gebäuden, Teil 1: Planung von Sanierungsmaßnahm Arbeitsblatt DWA-A 144 Entwässerungssystemen Gebäuden Teil 2: Statics Sanierung von Abwass kanälen mit Lining und Juli 2015 DIN EN 752 Entwässerungssysteme Gebäuden - Kanalmanage Zeitschrift 3R, Fachzeitsci	
ATV A 127, Abwassertech e.V., Arbeitsblatt A 127, Re Abfall, Vertrieb: GFA, DK 6 2000 DIN EN 1610, Verlegung Abwasserleitungen und Verlag, Berlin, 1997 Arbeitsblatt DWA-A 143 Entwässerungssystemen Gebäuden, Teil 1: Planung von Sanierungsmaßnahme Arbeitsblatt DWA-A 143 Entwässerungssystemen Gebäuden Teil 2: Statisc Sanierung von Abwassi kanälen mit Lining und Juli 2015 D I NEN 752 Entwässerungssysteme Gebäuden - Kanalmanage Zeitschrift 3R, Fachzeitsci	ines.
effiziente Rohrleitungssyst Handbuch für den Rohrl und 2, 4. Auflage, Günter V Rohrleitungstechnik, Walt Buchverlag, 2006 Stein D., Stein R., "In Kanalisationen", 1008 9810648-4-1 Verlag Pro Partner GmbH, 2014	egelwerk Abwasse 628.22 (083),A 12 g und Prüfung vor kanälen, Beu 3-1, Sanierung vor außerhalb vor a



11	Ernst & Sohn Verlag, 2003, ISBN: White Office Diagrams of the Companies of the McGraw-Hill - The McGraw-Hill Companies, Inc., 2005
12	Weidlich I., "Erddruck auf Rohre", 1. Auflage, ISBN 3-89999-027-7, 227 Seiten, 2012

Course L2006: Simula	tion of sewerage systems
Тур	Seminar
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 Modeling of sewer systems: Modeling approaches in wastewater management, especially approaches to integrated modeling Planning processes, calculations and design approaches for elements of gravity-sewers Model setup St. Venant equation and simplifications of models (kinematic wave etc.) Calculation & modeling of solids transport (advection, diffusion, dispersion and sales processes) Examples for modeling with SWMM (EPA, USA)
Literature	



Module M0874: V	Vastewater Systems			
Courses				
Title Wastewater Systems - Co		Typ Lecture Recitation Section (large) Lecture Recitation Section (large)	2	CP 2 1 2 1
Module Responsible	<u> </u>	(0 /		
Admission Requirements				
Recommended Previous Knowledge	Knowledge of wastewater management ar treatment.	nd the key processes	involved in	wastewate
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning results	3
Professional Competence Knowledge		dence for sustainable wa	-	
Skills	Students are able to pre-design and explain the available wastewater treatment processes and the scope of their application in municipal and for some industrial treatment plants.			
Personal Competence				
Social Competence	Social skills are not targeted in this module.			
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 96, Study Time in Le	cture 84		
Credit points	6			
Studienleistung	None			
	Written exam			
Examination duration and scale	120 min			
_	Civil Engineering: Specialisation Structural Engineering: Specialisation Geotechnical Civil Engineering: Specialisation Coastal Engineering: Specialisation Water and T Bioprocess Engineering: Specialisation Water and T Bioprocess Engineering: Specialisation A Compulsory Energy and Environmental Engineering: Specialisation A Compulsory International Management and Engineering: Engineering: Elective Compulsory International Management and Engineering Biotechnology: Elective Compulsory Process Engineering: Specialisation Encompulsory Process Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Specialisation Engineering: Specialisation Enginee	al Engineering: Elective of ineering: Elective Compineering: Elective Compineering: Elective Compineering: General Bioprocess ecialisation Environment g: Specialisation II. Encorpies Engineering: Elective Calisation Water: Compul	Compulsory bulsory bulsory see Engineeri tal Engineer ergy and Er occess Engineerin ompulsory sory	ng: Elective ring: Elective nvironmental neering and ng: Elective



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Waster	vater Systems - Collection, Treatment and Reuse
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	 •Understanding the global situation with water and wastewater •Regional planning and decentralised systems •Overview on innovative approaches •In depth knowledge on advanced wastewater treatment options for different situations, for end-of-pipe and reuse •Mathematical Modelling of Nitrogen Removal •Exercises with calculations and design
Literature	Henze, Mogens: Wastewater Treatment: Biological and Chemical Processes, Springer 2002, 430 pages George Tchobanoglous, Franklin L. Burton, H. David Stensel: Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy McGraw-Hill, 2004 - 1819 pages

Course L0943: Wastewater Systems - Collection, Treatment and Reuse		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Ralf Otterpohl	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0357: Advanced Wastewater Treatment		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Joachim Behrendt	
Language	DE	
Cycle	SoSe	
	Survey on advanced wastewater treatment	
	reuse of reclaimed municipal wastewater	
	Precipitation	
	Flocculation	
	Depth filtration	
Content	Membrane Processes	
	Activated carbon adsorption	
	Ozonation	
	"Advanced Oxidation Processes"	
	Disinfection	
Literature	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003	
	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987	
	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007	
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006	
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003	



Course L0358: Advanced Wastewater Treatment		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Joachim Behrendt	
Language	DE	
Cycle	SoSe	
	Aggregate organic compounds (sum parameters)	
	Industrial wastewater	
	Processes for industrial wastewater treatment	
	Precipitation	
Content	Flocculation	
	Activated carbon adsorption	
	Recalcitrant organic compounds	
Literature	Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, Boston 2003	
	Wassertechnologie, H.H. Hahn, Springer-Verlag, Berlin 1987	
	Membranverfahren: Grundlagen der Modul- und Anlagenauslegung, T. Melin und R. Rautenbach, Springer-Verlag, Berlin 2007	
	Trinkwasserdesinfektion: Grundlagen, Verfahren, Anlagen, Geräte, Mikrobiologie, Chlorung, Ozonung, UV-Bestrahlung, Membranfiltration, Qualitätssicherung, W. Roeske, Oldenbourg-Verlag, München 2006	
	Organische Problemstoffe in Abwässern, H. Gulyas, GFEU, Hamburg 2003	



Module M0828: Urban Environmental Management					
Courses					
Title Noise Protection (L1109)		Typ Lecture	Hrs/wk	CP 2	
Urban Infrastructures (L0	874)	Project-/problem-based Learning	2	4	
Module Responsible	Dr. Dorothea Rechtenbach				
Admission Requirements	None				
Recommended Previous Knowledge	 Knowledge on measures for climate n 				
Educational Objectives	After taking part successfully, students have reached the following learning results				
Professional Competence					
Knowledge	Students can describe urban development corridors as well as current and future urban environmental problems. They are able to explain the causes of environmental problems (like noise). Students can specify applications for various technical innovations and explain why these contribute to the improvement of urban life. They can, for example, derive and discuss measures for effective noise abatement.				
Skills	Students are able to develop specific solution related problems of urban development. They solutions for environmental problems for differential problems they can select tecturban context.	y can define a range of erent development paths	conceptual s. To solve	and technica specific urbai	
Personal Competence					
Social Competence	The students can work together in internation	al groups.			
Autonomy	Students are able to organize their work flow to prepare themselves for presentations and contributions to the discussions. They can acquire appropriate knowledge by making enquiries independently.				
	Independent Study Time 124, Study Time in L	ecture 56			
Credit points	1				
Studienleistung					
	Written elaboration				
Examination duration and scale	Written Report plus oral Presentation				
Assignment for the Following Curricula	Taolin Entobean Masier in Environneniai Sinoies - Cilles and Susialiaability. Core difallication				



Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise Protection		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Martin Jäschke	
Language	EN	
Cycle	SoSe	
Content		
Literature	 Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) WHO (1999): Guidelines for Community Noise Environmental Noise Directive 2002/49/EG ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation 	

Course L0874: Urban Infrastructures		
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	4	
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	Dr. Dorothea Rechtenbach	
Language	EN	
Cycle	SoSe	
Content	Problem Based Learning Main topics are: Central vs. Decentral Wastewater Treatment. Compaction of Cities. Car Free Cities. Multifunctional Places in Cities. The Sustainability of Freight Transport in Cities.	
Literature	Depends on chosen topic.	



oaalo Mo700. C	Soil and Groundwater Contam			
Courses				
Title Contamination and Reme	diation (L0547)	Typ Project Seminar	Hrs/wk 3	CP 3
NAPL in Soil and Ground		Lecture	1	1
NAPL in Soil and Ground	vater (L0546)	Recitation Section (small)	2	2
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	Geobydraulic and solute transpo	rt		
Educational Objectives	After taking part successfully, students ha	ave reached the following lea	rning resu	Its
Professional				
Competence				
Knowledge	The students are able to analyse contamination in soils and groundwater. They are able to create remediation concepts for LNAPL contamnations. They are faminiar with Monitore, Natural Attenuation			
Skills	The students are able to analyse contaminations in soils and groundwater using special engineering methods. They can do transport modelling in the unsaturated zone, estimations of groundwater pollution and analyse the impacts of remediation measures. They can forecast die distribution, mobility and remediation of non aquaous phase liquids in soil and groundwater.			
Personal				
Competence	! !	and the second s		
Social Competence	The students are able to prepare compl find remediation measures.	ex contamination issues in te	eamwork a	nd are able t
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time	in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	I Klausur 60 min: Referat 15 min:			
_	Civil Engineering: Specialisation Water a Water and Environmental Engineering: Swater and Environmental En	Specialisation Water: Elective Specialisation Environment: E	Compulso Elective Co	mpulsory

Water and Environmental Engineering: Specialisation Cities: Elective Compulsory



Course L0547: Contamination and Remediation		
Тур	Project Seminar	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	NN	
Language	DE	
Cycle	SoSe	
Content	Processing of a complex soil and groundwater contamination site. Students perform analyses of data to detect the contamination and to analyse the groundwater hazard and to develop a concept for remediation of the damage.	
Literature	entfällt	

Course L0545: NAPL i	ourse L0545: NAPL in Soil and Groundwater		
Тур	Lecture		
Hrs/wk	1		
СР	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	NN		
Language	DE		
Cycle	SoSe		
Content	concept of capillarity, multi phase distribution in poraus media, residual saturation, rellative permeability, infiltration of NAPL into the subsurface, vertical distribution of LNAPL, specific volume		
Literature	Charbeneau, R.J. (2000): Groundwater Hydraulics and pollutant Transport		

Course L0546: NAPL in Soil and Groundwater	
Recitation Section (small)	
2	
2	
Independent Study Time 32, Study Time in Lecture 28	
NN	
DE	
SoSe	
See interlocking course	
See interlocking course	



Module M1351: C	onstruction Proces	ses			
Courses					
Title		Тур		Hrs/wk	CP
Digital Building (L1908)		Lectu	re	2	2
Lean Construction (L1910		Lectu	_	2	2
System Dynamics (L1909))	Lectu	re	2	2
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	None				
Recommended Previous Knowledge					
Educational Objectives	After taking part successful	lly, students have reache	d the following lea	arning resul	ts
Professional					
Competence					
Knowledge					
Skills					
Personal					
Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 96	6, Study Time in Lecture	84		
Credit points	6				
Studienleistung	None				
Examination	Written exam				
Examination duration and scale	60 min				
_	Civil Engineering: Specialis Civil Engineering: Specialis Civil Engineering: Specialis Civil Engineering: Specialis	sation Geotechnical Engineers	neering: Elective ering: Elective Co	Compulsor mpulsory	у

Course L1908: Digital Building	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Katja Maaser
Language	DE
Cycle	SoSe
Content	
Literature	



Course L1910: Lean C	Course L1910: Lean Construction	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Theo Herzog	
Language	DE	
Cycle	SoSe	
Content		
Literature		

Course L1909: System	Course L1909: System Dynamics	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Nicole Mörchen, Dr. Markus Salge	
Language	DE	
Cycle	SoSe	
Content		
Literature		



Module M0871: H	lydrological Systems			
Courses				
Title Applied Surface Hydrology	y (L0289)	Typ Lecture	Hrs/wk 2	CP 2
Applied Surface Hydrolog	y (L1412)	Project-/problem-based Learning	1	2
Interaction Water - Enviro	nment in Fluvial Areas (L0295)	Project-/problem-based Learning	1	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
	Fundamentals of Hydromechanics and Hydr Hydraulic Engineering II	aulic Engineering: Hyd	raulic Engi	neering I and
Educational Objectives	After taking part successfully, students have re	eached the following lea	arning resul	ts
Professional				
Competence				
Knowledge	The students are able to define the basic concepts of hydrology and water management. They are able to describe and quantify the relevant processes of the hydrological water cycle. Besides, the students know the main aspects of rainfall-run-off-models and are able to theoretically derive established reservoir / storage models and a unit-hydrograph.			
Skills	The students are able to use the basic hydrological concepts and approaches and are able to theoretically derive established reservoir / storage models or a unit-hydrograph as the basis for rainfall-run-off-models. The student are able to explain the basic concepts of measurements of hydrological and hydrodynamic values in nature and are able to perform, analyze and statistically assess these measurements. Furthermore, they are able to apply a hydrological model to basic hydrological problems.			
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems of the hydrology and water management. Additionaly, they will be able to work in team with engineers of other disciplines.			
Autonomy	The students will be able to independently extend their knowledge and apply it to new			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Studienleistung	None			
	Written exam			
	The duration of the examination is 90 min. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.			
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Environmental Engineering: Core qualification: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Core qualification: Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory			



ourse L0289: Applied Surface Hydrology		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Peter Fröhle	
Language	DE/EN	
Cycle	SoSe	
Content	 Hydrological cycle Data acquisition Data analyses and statistical assessment Statistics of extremes Regionalization methods for hydrological values Rainfall-run-off modelling on the basis of a unit hydrograph conceps Application of rainfall-run-off models on the basis of Kalypso-Hydrology which is an OpenSource Software Tool. 	
Literature	http://de.wikipedia.org/wiki/Kalypso_(Software) http://kalypso.bjoernsen.de/ http://sourceforge.net/projects/kalypso/	

Course L1412: Applied	Course L1412: Applied Surface Hydrology	
Тур	Project-/problem-based Learning	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE/EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0295: Interac	Course L0295: Interaction Water - Environment in Fluvial Areas		
Тур	Project-/problem-based Learning		
Hrs/wk	1		
СР	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Peter Fröhle		
Language	DE/EN		
Cycle	SoSe		
Content	A problem based learning course. The problem will be solved by the students more or less self-contained. The topics will be introduced and elaborated over the semester.		
Literature	-		



Module M0857: G	Geochemical Engineering			
Courses				
Title Contaminated Sites and L Contaminated Sites and L Geochemical Engineering	andfilling (L0907)	Typ Lecture Recitation Section (large) Lecture	Hrs/wk 2 1 2	CP 2 2 2
Module Responsible				
Admission Requirements				
Recommended Previous Knowledge	Module: General and Inorganic Chemistry, Module:Organic Chemistry, Biology (Basic Knowledge)			
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning result	S
Professional				
Competence Knowledge	With the completion of this module students acquire profound knowledge of biogeochemical processes, the fate of pollutants in soil and groundwater, and techniques to deposit contaminated waste material. They are able to describe in principle the behaviour of chemicals in the environment. Students can explain and report the approach to remediate contaminated sites.			
Skills	With the completion of this module students can apply the acquired theoretical knowledge to model cases of site pollution and critically assess the situation technically and conceptually. They are able to draw comparisons on different remediation strategies and techniques. Model projects can be devised and treated.			
Personal				
Competence				
Social Competence	Students can discuss technical and scientific tasks within a seminar subject specific an interdisciplinary.			specific and
Autonomy	Students can independently exploit sources, acquire the particular knowledge of the subject and apply it to new problems.			
Workload in Hours	Independent Study Time 110, Study Time in L	ecture 70		
Credit points				
Studienleistung				
	Written exam			
Examination duration and scale	2 hours			
Assignment for the Following Curricula	TENVIRONMENTAL ENGINEERING: L'ORE GHAILTICATION: FIECTIVE L'OMPHIECTV			



Course L0906: Contan	ninated Sites and Landfilling
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth, Dr. Marco Ritzkowski
Language	EN
Cycle	SoSe
Content	The part Contaminated Sites gives an introduction into different scales of pollution and identifies key pollutants. Geochemical attenuation mechanisms and the role of organisms are highlighted affecting the fate of pollutants in leachate and groundwater. Techniques for site characterization and remediation are discussed including economical aspects. The part Landfilling is introduced by discussing fundamental aspects and the worldwide situation of waste management. The lecture highlights transformation processes in landfill bodies, emissions of gases and leachate, and the long-term behaviour of landfill sites with measures of aftercare.
Literature	1) Waste Management. Bernd Bilitewski; Georg Härdtle; Klaus Marek (Eds.), ISBN: 9783540592105, Springer Verlag Lehrbuchsammlung der TUB, Signatur USH-305 2) Solid Waste Technology and Management. Thomas Christensen (Ed.), ISBN: 978-1-4051-7517-3, Wiley Verlag Lesesaal 2: US - Umweltschutz, Signatur USH-332 3) Natural attenuation of fuels and chlorinated solvents in the subsurface. Todd H. Wiedemeier(Ed.), ISBN: 0471197491 Lesesaal 2: US - Umweltschutz, Signatur USH-844

Course L0907: Contan	Course L0907: Contaminated Sites and Landfilling		
Тур	Recitation Section (large)		
Hrs/wk	1		
СР	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Dr. Joachim Gerth, Dr. Marco Ritzkowski		
Language	EN		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



Course L0904: Geoche	emical Engineering
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth
Language	EN
Cycle	SoSe
Content	As an introduction cases are presented in which geochemical engineering was used to solve environmental problems. Environmentally important minerals are discussed and methods for their detection. It is demonstrated how solution equilibria can be modified to eliminate elevated concentrations of unwanted species in solution and how carbon dioxide concentration affects pH and the dissolution of carbonate minerals. Modifications of redox conditions, pH, and electrolyte concentration are shown to be effective tools for controlling the mobility and fate of hazardous species in the environment.
Literature	Geochemistry, groundwater and pollution. C. A. J. Appelo; D. Postma Leiden [u.a.] Balkema 2005 Lehrbuchsammlung der TUB, Signatur GWC-515



Modulo M0975. N	lovus Engineering Woter Soil I	Food and Engra		
wodule woo75: r	lexus Engineering - Water, Soil, I	rood and Energ	у	
Courses				
Title		Тур	Hrs/wk	СР
	Water, Energy, Soil and Food Nexus (L1229)	Seminar	2	2
Water & Wastewater Sys	tems in a Global Context (L0939)	Lecture	2	4
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	INone			
Recommended Previous Knowledge	Laitian lank of water recourses and conitation		il degradation	, migration to
Educational Objectives	After taking part successfully students have	reached the following	learning resu	its
Professional Competence				
Knowledge	Students can describe the facets of the global water situation. Students can judge the enormous potential of the implementation of synergistic systems in Water, Soil, Food and Energy supply.			
Skills	Students are able to design ecological settlements for different geographic and socioeconomic conditions for the main climates around the world.			
Personal Competence				
Social Competence	The students are able to develop a speci according to a given plan.	fic topic in a team a	and to work o	ut milestones
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 Lecture 56			
Credit points	6			
Studienleistung	None			
Examination	Subject theoretical and practical work			
Examination duration and scale	Inresentations and naners. Detailed information can be found at the beginning of the smester			
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory Chemical and Bioprocess Engineering: Specialisation General Process Engineering: Elective Compulsory Environmental Engineering: Core qualification: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Core qualification: Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory			



Course L1229: Ecologi	cal Town Design - Water, Energy, Soil and Food Nexus
Тур	Seminar
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	 Participants Workshop: Design of the most attractive productive Town Keynote lecture and video The limits of Urbanization / Green Cities The tragedy of the Rural: Soil degradation, agro chemical toxification, migration to cities Global Ecovillage Network: Upsides and Downsides around the World Visit of an Ecovillage Participants Workshop: Resources for thriving rural areas, Short presentations by participants, video competion TUHH Rural Development Toolbox Integrated New Town Development Participants workshop: Design of New Towns: Northern, Arid and Tropical cases Outreach: Participants campaign City with the Rural: Resilience, quality of live and productive biodiversity
Literature	 Ralf Otterpohl 2013: Gründer-Gruppen als Lebensentwurf: "Synergistische Wertschöpfung in erweiterten Kleinstadt- und Dorfstrukturen", in "Regionales Zukunftsmanagement Band 7: Existenzgründung unter regionalökonomischer Perspektive, Pabst Publisher, Lengerich http://youtu.be/9hmkgn0nBgk (Miracle Water Village, India, Integrated Rainwater Harvesting, Water Efficiency, Reforestation and Sanitation) TEDx New Town Ralf Otterpohl: http://youtu.be/_M0J2u9BrbU



Course L0939: Water 8	& Wastewater Systems in a Global Context
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	 Keynote lecture and video Water & Soil: Water availability as a consequence of healthy soils Water and it's utilization, Integrated Urban Water Management Water & Energy, lecture and panel discussion pro and con for a specific big dam project Rainwater Harvesting on Catchment level, Holistic Planned Grazing, Multi-Use-Reforestation Sanitation and Reuse of water, nutrients and soil conditioners, Conventional and Innovative Approaches Why are there excreta in water? Public Health, Awareness Campaigns Rehearsal session, Q&A
Literature	 Montgomery, David R. 2007: Dirt: The Erosion of Civilizations, University of California Press Liu, John D.: http://eempc.org/hope-in-a-changing_climate/ (Integrated regeneration of the Loess Plateau, China, and sites in Ethiopia and Rwanda) http://youtu.be/9hmkgn0nBgk (Miracle Water Village, India, Integrated Rainwater Harvesting, Water Efficiency, Reforestation and Sanitation)



Courses						
Title City Planning (L1066)		Typ Project-/problem-based Learning	Hrs/wk	CP 6		
Module Responsible						
Admission Requirements						
		or "Principles of Urban Planning": none or "Designing Urban Streetscapes": some knowledge of transport planning, e.g. through uking the undergraduate class "Transport Planning and Traffic Engineering"				
Educational Objectives	After taking part successfully, students have re-	ached the following lea	rning resul	ts		
Professional Competence						
Knowledge	 • use technical terms of urban planning. • describe the main determinants of urban development. • explain and compare different possibilities of how urban development can be influenced. • discuss requirements for public streetscapes. • explain the importance of street design. 					
Skills	 • read and analyze urban development concepts and designs for streetscapes • appraise such concepts in the context of competing requirements. • design, justify and reflect their own solutions for concrete examples. 					
Personal Competence	Students are able to:					
Social Competence	 discuss intermediate results with each other. constructively accept feedback on their own work. provide constructive feedback to others. 					
Autonomy	Students are able to: • independently complete a written report including drawings following a broadly predefined process. • assess the consequences of their proposed solutions. • independently acquire knowledge and apply this to new issues or problem areas.					
	Independent Study Time 124, Study Time in Le					



Credit points	6		
Studienleistung	None		
Examination	ritten elaboration		
Examination duration and scale	I written assignment, designwork during the semester		
Assignment for the Following Curricula	H odistics intrastructure and Mobility. Specialisation intrastructure and Mobility. Flectivel		

Course L1066: City Pla	anning			
Тур	Project-/problem-based Learning			
Hrs/wk	4			
СР	6			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Lecturer	Prof. Carsten Gertz			
Language	DE			
Cycle	SoSe			
Content	"Principles of Urban Planning" deals with the determinants of urban development and their interactions. Topics include: • legal framework, • instruments and methods of planning, • functional requirements, • stakeholders and actors • basic design requirements • different planning levels and • historical contexts. The objective of the course is for students to acquire a basic understanding of urban development problems and approaches for solving them. They will also be able to comprehend the process of urban planning. The course also covers the various functional and aesthetic requirements for designing streetscape as the most important elements of public space. The project work deals with a real life scenario and includes drawing up a development plan, an urban design concept, a building masterplan and a street redesign.			
Literature	Albers, Gerd; Wekel, Julian (2009) Stadtplanung: Eine illustrierte Einführung. Primus Verlag. Darmstadt. Frick, Dieter (2008) Theorie des Städtebaus: Zur baulich-räumlichen Organisation von Stadt. Wasmuth-Verlag. Tübingen Jonas, Carsten (2009) Die Stadt und ihr Grundriss. Wasmuth-Verlag. Tübingen Kostof, Spiro; Castillo, Greg (1998) Die Anatomie der Stadt. Geschichte städtischer Strukturen. Campus-Verlag. Frankfurt/New York.			



Courses							
Fitle				Тур		Hrs/wk	СР
Construction Logistics (L1	1163)			Lecture		1	2
Construction Logistics (L1				Recitation Sect	ion (small)	1	2
Project Development and	Managemen	it (L1161)		Lecture		1	1
Project Development and	Managemen	it (L1162)		Project-/proble Learning	m-based	1	1
Module Responsible	Prof. Heike	e Flämig					
Admission Requirements	None						
Recommended Previous Knowledge	none						
Educational Objectives	After taking	g part succes	sfully, students h	ave reached the foll	owing lear	rning resul	lts
Professional Competence							
Knowledge	 give definitions of the main terms of construction logistics and project development and management name advantages and disadvantages of internal or external construction logistics explain characteristics of products, demand and production of construction objects and their consequences for construction specific supply chains differentiate constructions logistics from other logistics systems 						
Skills	 carry out project life cycle assessments apply methods and instruments of construction logistics apply methods and instruments of project development and management apply methods and instruments of conflict management design supply and waste removal concepts for a construction project 						
Personal Competence							
·	Students o	an					
Social Competence		•	ons in and for gro of conflict solving	ups skills in group work	and case	studies	
Autonomy	Students can solve problems by holistic, systemic and flow oriented thinking improve their creativity, negotiation skills, conflict and crises solution skills by applying methods of moderation in case studies						
Workload in Hours	Independe	ent Study Tim	e 124, Study Tim	e in Lecture 56			
Credit points	6						
Studienleistung	None						
Examination	Written ela	boration					
Examination duration	Two writto						
and scale	I wo writte	n papers with	presentations				



	Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory
Assignment for the Following Curricula	International Management and Engineering: Specialisation II. Civil Engineering: Elective

Tvpl	Lecture
Hrs/wk	
СР	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
	Prof. Heike Flämig
Language	DE
Cycle	SoSe
Content	The lecture gives deeper insight how important logistics are as a competetive factor for construction projects and which issues are to be addressed. The following toppics are covered: • competetive factor logistics • the concept of systems, planning and coordination of logistics • material, equipment and reverse logistics • IT in construction logistics • elements of the planning model of construction logistics and their connections • flow oriented logistics systems for construction projects • logistics concepts for ready to use construction projects (especially procurement ar waste removel logistics) • best practice examples (construction logistics Potsdamer Platz, recent case study the region) Contents of the lecture are deepened in special exercises.
Literature	Flämig, Heike: Produktionslogistik in Stadtregionen. In: Forschungsverbund Ökologisch Mobilität (Hrsg.) Forschungsbericht Bd. 15.2. Wuppertal 2000. Krauss, Siri: Die Baulogistik in der schlüsselfertigen Ausführung, Bauwerk Verlag Gmb Berlin 2005. Lipsmeier, Klaus: Abfallkennzahlen für Neubauleistungen im Hochbau: Verlag Forum f Abfallwirtschaft und Altlasten, 2004. Schmidt, Norbert: Wettbewerbsfaktor Baulogistik. Neue Wertschöpfungspotenziale in d Baustoffversorgung. In: Klaus, Peter: Edition Logistik. Band 6. Deutscher Verkehrs-Verla Hamburg 2003. Seemann, Y.F. (2007): Logistikkoordination als Organisationseinheit bei der Bauausführur Wissenschaftsverlag Mainz in Aachen, Aachen. (Mitteilungen aus dem Fachgebiet Baubetrie und Bauwirtschaft (Hrsg. Kuhne, V.): Heft 20)



Course L1164: Construction Logistics			
Тур	Recitation Section (small)		
Hrs/wk	1		
СР	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Heike Flämig		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L1161: Project Development and Management				
Тур	Lecture			
Hrs/wk	1			
СР	1			
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14			
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei			
Language	DE			
Cycle	SoSe			
Content	 Within the lecture, the main aspects of project development and management are tought: Terms and definitions of project management Advantages and disadvantages of different ways of project handling organization, information, coordination and documentation cost and fincance management in projects time- and capacity management in projects specific methods and instruments for successful team work Contents of the lecture are deepened in special exercises.			
Literature	Projektmanagement-Fachmann. Band 1 und Band 2. RKW-Verlag, Eschborn, 2004.			

Course L1162: Project Development and Management			
Тур	Project-/problem-based Learning		
Hrs/wk	1		
СР	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Heike Flämig, Dr. Anton Worobei		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



Courses					
Title Anchor Technology and Design, Post Installed Rebar Connections (L0257) Repair of Structures (L0255) Mineral Building Materials (L0253)		Typ Recitation Section (small) Lecture Lecture	Hrs/wk 1 1 2	CP 1 1 2	
Technology of mineral Bui			Project-/problem-based Learning	1	1
ransport Processes in B	uilding Materials and Damage F	Processes (L0254)	Lecture	1	1
Module Responsible	Prof. Frank Schmidt-Döhl				
Admission Requirements	None				
	Basic knowledge about building materials, building physics and building chemistry, for example by the modules Principles of Building Materials and Building Physics and Building Materials and Building Chemistry.				
Educational Objectives	After taking part successfully, students have reached the following learning results				
Professional Competence					
Knowledge	The students are able to describe the components of mineral building materials and the function in detail and to use them for the manufacture of special mineral building materials. They are able to show the characteristics of mineral building materials. They are able to describe the manufacture, properties and fields of application of special mortars and special concretes and the correlations of their material parameters. They are able to show the principles of anchor technology and design.				
Skills	The students are able to perform an optimization of granulometry of a mineral buildin material. They are able to design a special mineral mortar and to manufacture this mortar. Th students are able to manufacture post installed rebar connections. They are able to recogniz damages, to assess possible causes, to use the fundamentals of construction preservatio and to select repair and strengthening measures.				
Personal Competence					_
Social Competence	The students are able to develop in small grous the mixture of a special mortar. They presen their results to the lecturer and the other students. In a critical discussion they defend and adjust their results. The students are able to manufacture their special building material on the basis of this feedback.				
Autonomy	The students are able to responsibly use the resources of materials and lab equipment fo their project and to investigate and to get missing components.				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84				
Credit points	6				
Studienleistung	Yes 20 %	Form Subject theore practical work	Descriptio tical and	n	
Examination					



Assignment for the
Following Curricula

Civil Engineering: Specialisation Geotechnical Engineering: Compulsory
Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory
Civil Engineering: Specialisation Structural Engineering: Elective Compulsory

Civil Engineering: Specialisation Water and Traffic: Elective Compulsory

Course L0257: Anchor	Technology and Design, Post Installed Rebar Connections
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	 Working principles of friction, keying and bonding anchors Selection of anchors Anchor design Installation of anchors Post installed rebar connections and additional german regulations
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung Beton-Kalender 2012: Infrastrukturbau, Befestigungstechnik. Eurocode 2. Herausgegeben von Konrad Bergmeister, Frank Fingerloos und Johann-Dietrich Wörner; 2012 Ernst & Sohn GmbH & Co. KG. Published by Ernst & Sohn GmbH & Co. KG. DIBt: Hinweise für die Montage von Dübelverankerungen; Oktober 2010 Ratgeber Dübeltechnik, Basiswissen - Metalldübel, chemische Dübel, Kunststoffdübel; Herausgeber Hilti AG

Course L0255: Repair of Structures				
Тур	Lecture			
Hrs/wk	1			
СР	1			
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14			
Lecturer	Prof. Frank Schmidt-Döhl			
Language	DE			
Cycle	SoSe			
Content	Maintenance of structures, repair and strengthening, subsequent waterproofing of structures			
Literature	BetonMarketing Deutschland (Hrsg.): Stahlbetonoberflächen - schützen, erhalten, instandsetzen			



Course L0253: Minera	l 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	SoSe
	Components of mineral building materials and their function, binding materials, concrete and mortar, special mortars, special concretes
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis

Course L0256: Technology of mineral Building Materials					
Тур	Typ Project-/problem-based Learning				
Hrs/wk					
СР	1				
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14				
Lecturer	Prof. Frank Schmidt-Döhl				
Language	DE				
Cycle	SoSe				
Content	Design and production of a special mineral building material				
	Taylor, H.F.W.: Cement Chemistry				
Literature	Springenschmid, R.: Betontechnologie für die Praxis				

Course L0254: Transport Processes in Building Materials and Damage Processes			
Тур	Lecture		
Hrs/wk	1		
СР	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Frank Schmidt-Döhl, Dr. Gernod Deckelmann		
Language	DE		
Cycle	SoSe		
Content	Transport Processes in Building Materials and Damage Processes		
Literature	Blaich, J.: Bauschäden, Analyse und Vermeidung		



Module M0998: S	Statics and Dynamics of Structure	s		
Courses				
Title		Тур	Hrs/wk	СР
Structural Dynamics (L1202)		Lecture	2	2
Structural Dynamics (L1203)		Recitation Section (large)	2	2
	fatigue in steel structures (L0564)	Lecture	1	1
Fracture Mechanics and I		Recitation Section (large)	1	1
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	Machanias I/II Mathanastics I/II Differential and	•	indetermina	ate structures
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning resul	ts
Professional				
Competence	After successful completion of this module, the student can explain the basic aspects of dynamic effects on structures and the respective methods.			
Knowledge Skills	After successful completion of this module, the material and structures to dynamics loading u and methods.		•	
Personal				
Competence				
Social Competence	participate in subject-specific and inter defend their own work results in front o promote the scientific development of o Furthermore, they can give and accept	f others colleagues		
Autonomy	Students are able to gain knowledge of the apply it to new problems. Furthermore, they problems in the area of Structural Analysis.	-		
Workload in Hours	Independent Study Time 96, Study Time in Le	cture 84		
Credit points	6			
Studienleistung	None			
	Written exam			
Examination duration and scale	150 min			
Assignment for the	Civil Engineering: Specialisation Structural En Civil Engineering: Specialisation Geotechnica Civil Engineering: Specialisation Coastal Engi	I Engineering: Elective	•	у



Following Curricula	ng Curricula Civil Engineering: Specialisation Water and Traffic: Elective Compulsory							
	International	Management an	d Engineering	g: Specialisation	II.	Civil	Engineering:	Elective
	Compulsory							

Course L1202: Structu	ıral Dynamics
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	SoSe
Content	 Single-degree-of-freedom systems: undamped and damped vibration, free vibration, forced vibrations due to harmonic, periodical or arbitrary loading, natural frequency, damping vibration isolation solution in the frequency-domain (Fourier transformation), solution in the time-domain multi-degree-of-freedom systems: continuous or discrete systems, modelling with finite elements, generalisation modal analysis power iteration according to v.Mises earthquake loading: seismological basics, response spectrum method wind-induced vibrations: engineering meteorology, aerodynamic, classification of excitation mechanisms progressive collapse
Literature	Clough, R.W., Penzien, J.: Dynamics of Structures. 2. Aufl., McGraw-Hill, New York, 1993.

Course L1203: Structural Dynamics		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



	re mechanics and fatigue in steel structures
	Lecture
Hrs/wk	
CP	
	Independent Study Time 16, Study Time in Lecture 14
	Dr. Ingo Hadrych
Language	
Cycle	basics of fatigue stress and fatigue resistance and determination of fatigue strength,
	determination anduse of S-N-curves and classification of notch effects,
	 set up of determination of fatigue strength under dynamic load using the accumulati formula by Palmgren-Miner,
Content	· set up of determination of fatigue strength in different examples,
	- basics of construction and design regarding the problem of material fatigue,
	basics of linear elastic fracture mechanics under static and dynamic load,
	 determination of lifetime of steel construction based on linear elastic fracture mechanics different examples.
	 Seeßelberg, C.; Kranbahnen - Bemessung und konstruktive Gestaltung; 3. Auflage; Bauwerk-Verlag; Berlin 2009 Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 200 Verlag Ernst & Sohn; Berlin 2003
	 Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Auflag Stahlbau-Verlagsgesellschaft; Köln 1996
	· Petersen, C.; Stahlbau; 3. überarb. und erw. Auflage; Vieweg-Verlag; Braunschweig 1993
	 DIN V ENV 1993-1-1: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; T 1-1: Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993
	 DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil Kranbahnen; 2001
Literature	DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; Nationa Anwendungsdokument (NAD); Berlin 2002



Course L0565: Fracture Mechanics and Fatigue		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Ingo Hadrych	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0982: T	ransportation Modelling			
Courses				
Title		Тур	Hrs/wk	СР
Transportation Modelling ((L1180)	Project-/problem-based Learning	4	6
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous Knowledge	some knowledge of transport planning, e.g. through taking the undergraduate class "Transport Planning and Traffic Engineering"			
Educational Objectives	After taking part successfully, students hav	re reached the following lea	arning resu	lts
Professional Competence				
Knowledge	Students are able to understand the opera	tion and potential applicati	ons of trans	sport models.
Skills	 students are able to: use travel demand modelling software packages for solving practical problems. design a database structure for travel demand models. assess modelling results. appraise potential applications and limitations of such models. 			
Personal Competence Social Competence Autonomy	Students are able to independently develor Students are able to: • independently organise, manage a	and solve set tasks.		
Workload in Hours	Independent Study Time 124, Study Time	in Lecture 56		
Credit points	6			
Studienleistung				
Examination	Written elaboration			
Examination duration and scale	written assignment with presentation durin	g the semester		
Assignment for the Following Curricula	Civil Engineering: Specialisation Water an Logistics, Infrastructure and Mobility: S Compulsory Water and Environmental Engineering: Sp	pecialisation Infrastructure		-



Course L1180: Transportation Modelling		
Тур	Project-/problem-based Learning	
Hrs/wk	4	
СР	6	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Lecturer	Prof. Carsten Gertz	
Language	DE	
Cycle	SoSe	
Content	 Principles of transport modelling Role of transport modelling in the planning process Fundamentals of mobility behaviour Design and evaluation of transport/mobility surveys mode of operation and data requirements for different stages of modelling Forecasting and scenarios in the transport planning The range of model applications (from transport infrastructure planning over simulation of traffic flows to integrated land-use and transport models as well as the use of models for evaluating locations) Practice-oriented project for assessing consequences of infrastructure projects and changes in land-use 	
Literature	Lohse, Dieter und Schnabel, Werner (2011): Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung – Band 2. 3. Auflage. Beuth. Ortúzar, Juan de Dios und Willumsen, Luis G. (2011): Modelling Transport. 4. Auflage. John Wiley & Sons.	



Courses					
Title		Тур	Hrs/wk	СР	
	hnology for Biomass (L0052)	Lecture	2	2	
Thermal Waste Treatmen	,	Lecture	2	2	
Thermal Waste Treatmen	t (L1177)	Recitation Section (arge) 1	2	
Module Responsible					
Admission Requirements	None				
	Basics of				
Recommended	 thermo dynamics 				
Previous Knowledge	 fluid dynamics 				
	chemistry				
Educational	After telding ment access of the stand			11-	
Objectives	After taking part successfully, stude	ents nave reached the followin	ig learning resu	ITS	
Professional					
Competence	The students can name, describe	ourrent icoup and problems	in the field of	thormal woot	
	treatment and particle process eng	-			
Knowledge	The industrial application of unit operations as part of process engineering is explained by actual examples of waste incineration technologies and solid biomass processes.				
Mowicage	Compostion, particle sizes, transport	_		•	
	resources and wastes are describ				
	and bioethanol, producing and ref	ning edible oils, electricity, he	eat and mineral	recyclables.	
	The students are able to select su	itable processes for the treatn	nent of wastes o	r raw materia	
Skills	with respect to their characteristic	s and the process aims. They	can evaluate t		
	costs for processes and select eco	nomically feasible treatment c	oncepts.		
Personal					
Competence					
	Students can				
	 respectfully work together a 	as a team and discuss technica	al tasks		
Social Competence		fic and interdisciplinary discus	sions,		
	develop cooperated solution promote the scientific deve	ins Hopment and accept professio	nal constructive	criticism	
	promote the scientific deve	nopment and accept professio	nai constiuctive	CHUCISITI.	
	Students can independently tap	-			
	questions. They are capable, in c	•		-	
Autonomy	and define further steps on thi application-or research-oriented d	•		-	
	cultural impact.	and in addordance with the p	otomiai ocoiai,		
Warldood in Harry	hadanaadankOhidu Tiraaddo Ohio	h. Time a im Lankova 70			
	Independent Study Time 110, Stud	iy rime in Lecture 70			
Credit points Studienleistung					
Judienielstung					
	i willen exam				
Examination					
	120 min				



	Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory
Assignment for the Following Curricula	Energy and Environmental Engineering: Specialisation Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Process Engineering and Biotechnology: Elective Compulsory International Management and Engineering: Specialisation II. Benewable Energy: Elective
	Renewable Energies: Specialisation Bioenergy Systems: Elective Compulsory Process Engineering: Specialisation Chemical Process Engineering: Elective Compulsory Process Engineering: Specialisation Process Engineering: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0052: Solid M	atter Process Technology for Biomass
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Werner Sitzmann
Language	DE
Cycle	SoSe
Content	The industrial application of unit operations as part of process engineering is explained by actual examples of solid biomass processes. Size reduction, transportation and dosing, drying and agglomeration of renewable resources are described as important unit operations when producing solid fuels and bioethanol, producing and refining edible oils, when making Btl - and WPC - products. Aspects of explosion protection and plant design complete the lecture.
Literature	Kaltschmitt M., Hartmann H. (Hrsg.): Energie aus Bioamsse, Springer Verlag, 2001, ISBN 3-540-64853-4 Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz, Schriftenreihe Nachwachsende Rohstoffe, Fachagentur Nachwachsende Rohstoffe e.V. www.nachwachsende-rohstoffe.de Bockisch M.: Nahrungsfette und -öle, Ulmer Verlag, 1993, ISBN 380000158175



Course L0320: Therma	al Waste Treatment
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta, Dr. Joachim Gerth, Dr. Ernst-Ulrich Hartge
Language	EN
Cycle	SoSe
Content	 Introduction, actual state-of-the-art of waste incineration, aims. legal background, reaction principals basics of incineration processes: waste composition, calorific value, calculation of air demand and flue gas composition Incineration techniques: grate firing, ash transfer, boiler Flue gas cleaning: Volume, composition, legal frame work and emission limits, dry treatment, scrubber, de-nox techniques, dioxin elimination, Mercury elimination Ash treatment: Mass, quality, treatment concepts, recycling, disposal
Literature	Thomé-Kozmiensky, K. J. (Hrsg.): Thermische Abfallbehandlung Bande 1-7. EF-Verlag für Energie- und Umwelttechnik, Berlin, 196 - 2013.

Course L1177: Thermal Waste Treatment		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Dr. Ernst-Ulrich Hartge, Dr. Joachim Gerth	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module Model. N	Modeling in Water Management			
Courses				
Title Applied Groundwater Mod Applied Groundwater Mod Modeling of Water Supply		Typ Lecture Recitation Section (small) Project-/problem-based Learning	Hrs/wk 1 2	CP 1 2 3
Madala Danasa Sala	Laise	Learning		
Module Responsible Admission				
Requirements	INone			
Recommended Previous Knowledge	Groundwater • groundwater hydraulics and transp Pipe Systems • Knowledge on urban water infras urban drainage systems including s • Hydraulics of drinking water supply • Basic knowledge on water manage	structures, in particular drin special structures r systems and sewer system		er systemsar
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence Knowledge	The students are able to describe the modelling of groundwater flow and transport as well as urban water infrastructures. They can carry out systems analyses and can detect technical and conceptual weak points within the systems in case studies. Besides they are able to analyse			
Skills	The students are able to construct and apply scientific groundwater models indipendently They can work on different scenarios and can compare or assess different solutions for existing problems by application of selected software products. The students are able to use different software solutions (e.g. EPANET, EPA-SWMM).			
Personal Competence				
Social Competence	1 1.0/j.mal mindat va monitta lt			
Autonomy	Wird nicht vermittelt.			
Workload in Hours	Independent Study Time 110, Study Time i	in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Oral exam			
Examination duration and scale	20 min			
	Civil Engineering: Specialisation Structura Civil Engineering: Specialisation Geotechr			у



Assignment for the Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Following Curricula Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory

Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0543: Applied Groundwater Modeling		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Sonja Schröter	
Language	DE/EN	
Cycle	SoSe	
Content	Introduction and application of the groundwater model MODFLOW (PMWIN); theoretical backround of the modell, students do work with the model PMWIN for practical case studies.	
Literature	MODFLOW-Handbuch Chiang, Wen Hsien: PMWIN	

Course L0544: Applied Groundwater Modeling	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Schröter
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0875: Modeling of Water Supply and Sewer Network		
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Klaus Johannsen, Weitere Mitarbeiter	
Language	DE	
Cycle	SoSe	
Content		
Literature	Mutschmann/Stimmelmayr: Taschenbuch der Wasserversorgung, 16. Auflage. Springer Vieweg - Verlag. Wiesbaden 2014.	



Module M0870: N	lanagement of Surface Water			
Courses				
Title Modelling of Flow in River	s and Estuaries (L0810)	Typ Lecture	Hrs/wk 3	CP 4
Nature-Oriented Hydraulio	c Engineering / Integrated Flood Protection (L0961)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
	Fundamentals of Hydromechanics, Hydrau Hydraulic Engineering I and Hydraulic Engine		Hydraulic	Engineering;
Educational Objectives	After taking part successfully, students have re	eached the following lea	arning result	S
Professional Competence				
Knowledge	Students are able to define in detail the basic processes that are related to the modelling of flows in hydraulic engineering. Besides, they can describe the basic aspects of numerical modelling and actual numerical models for the simulation of flows and waves. They can also depict the concepts of nature oriented hydraulic engineering.			
Skills	Students are able to apply hydrodynamic-numerical models to practical hydraulic engineering tasks. Furthermore, the students are able to set up flood-risk management concepts and are able to apply basic concepts of renaturation to practical problems.			
Personal				
Competence				
Social Competence	The students are able to deploy their gained knowledge in applied problems of the practical nature-based hydraulic engineering. Additionaly, they will be able to work in team with engineers of other disciplines.			
Autonomy	The students will be able to independently extend their knowledge and apply it to new			
Workload in Hours	Independent Study Time 110, Study Time in L	ecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
	The duration of the examination is 150 min. The general understanding of the lecture contents		s tasks with	respect to the
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and T Environmental Engineering: Core qualification Joint European Master in Environmental Stud Compulsory Water and Environmental Engineering: Special Water and Environmental Engineering: Special Water and Environmental Engineering: Special	n: Elective Compulsory ies - Cities and Sustaina alisation Water: Compul alisation Environment: C	lsory Compulsory	



Course L0810: Modelling of Flow in Rivers and Estuaries		
Тур	Lecture	
Hrs/wk	3	
СР	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Dr. Edgar Nehlsen, Prof. Peter Fröhle	
Language	DE/EN	
Cycle	SoSe	
Content	 Initial conditions and boundary conditions Numerical Methods Time step procedure Finite differences Finite volumes 	
1.00	Norda a construir d	
Literature	Vorlesungsskript	

Course L0961: Nature	-Oriented Hydraulic Engineering / Integrated Flood Protection
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Natasa Manojlovic, Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	 Regime-Theory and application for the development of environmental guiding priciples of rivers Engineering - biological measures for the stabilization of rivers Risk management in flood protection Design techniques in technical flood protection Methods for the assessment of flood caused damages
Literature	Vorlesungsumdruck



Module M1350: E	Excavation Law and Projects			
Courses				
Title		Тур	Hrs/wk	СР
Subsoil and Underground	Engineering Law (L0395)	Lecture	2	2
Service Contract and Pro		Lecture	2	2
Project Geotechnics (L07	(80)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	INone			
Recommended Previous Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional				
Competence	! !			
Knowledge				
Skills				
Personal				
Competence				
Social Competence	! 			
Autonomy				
	Independent Study Time 96, Study Time in L	ecture 84		
Credit points				
Studienleistung	None			
Examination	Oral exam			
Examination duration and scale	15 min			
Assignment for the Following Curricula	Civil Engineering: Specialisation Coastal Er Civil Engineering: Specialisation Geotechnic Civil Engineering: Specialisation Structural E Civil Engineering: Specialisation Water and	cal Engineering: Elective Engineering: Elective Co	Compulsor mpulsory	у



Course L0395: Subsoi	l and Underground Engineering Law
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Georg-Friedger Drewsen
Language	DE
Cycle	WiSe
Content	 Introduction Historical Overview Areas of civil law The Contracting Parties Authorities, Cooperatioves and other patries involved The Civil law The Public Service Obligations Land acquisition Planning of underground construction projects The construction contract according to BGB/VOB - design and implementation The civil law in the jurisdiction
Literature	Folienskipt (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner- Verlag

Course L1906: Service Contract and Procurement Law	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Günther Schalk, Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	
Literature	



Course L0708: Project Geotechnics		
Тур	Project-/problem-based Learning	
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	The students solve independently a project-based geotechnical problem in groups. Additional lectures concerning the problem will be held and material will be distributed as study basis. Every two weeks the groups present their current project status. The final work will be presentated in a final presentation.	
Literature	abhängig von der Fragestellung	



Module M0619: V	Vaste Treatment 1	Technolog	ies					
Courses								
Title Waste and Environmental	Chemistry (L0328)		Р	yp ractical Course	Hrs/wk 2	CP 2		
Biological Waste Treatme	nt (L0318)			roject-/problem-based earning	3	4		
Module Responsible	Prof. Kerstin Kuchta							
Admission Requirements	None							
Recommended Previous Knowledge	chemical and biologica	l basics						
Educational Objectives	After taking part succes	sfully, students	s have read	ched the following le	arning resu	Its		
Professional								
Competence] 							
Knowledge	The module aims poss plants. Students are al treatment plants in de biological waste treatm	ble to explain tail, describe	the desigr different te	and layout of ana chniques for waste	erobic and gas treatm	aerobic waste ent plants fo		
Skills	The students are able to discuss the compilation of design and layout of plants. They can critically evaluate techniques and quality control measurements. The students can recherché and evaluate literature and date connected to the tasks given in der module and plan additional tests. They are capable of reflecting and evaluating findings in the group.							
Personal Competence								
Social Competence	Students can participate in subject-specific and interdisciplinary discussions, develop cooperated solutions and defend their own work results in front of others and promote the scientific development in front of colleagues. Furthermore, they can give and accept professional constructive criticism.							
Autonomy	Students can independently tap knowledge from literature, business or test reports and transform it to the course projects. They are capable, in consultation with supervisors as well as in the interim presentation, to assess their learning level and define further steps on this basis. Furthermore, they can define targets for new application-or research-oriented duties in accordance with the potential social, economic and cultural impact.							
Workload in Hours	Independent Study Tim	e 110, Study T	ime in Lec	ture 70				
Credit points	6							
Studienleistung	Compulsory Bonus Yes None	Subject theoretical and						
Examination								
	Flaboration and Preser	ntation (15-25 ı	minutes in	groups)				
and scale								



Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Core qualification: Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Energy: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory
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Course L0328: Waste	and Environmental Chemistry
Тур	Practical Course
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
Language	DE/EN
Cycle	WiSe
Content	The participants are divided into groups. Each group prepares a transcript on the experiment performed, which is then used as basis for discussing the results and to evaluate the performance of the group and the individual student. In some experiments the test procedure and the results are presented in seminar form, accompanied by discussion and results evaluation. Experiments ar e.g. Screening and particle size determination Fos/Tac AAS Chalorific value
Literature	Scripte



Course L0318: Biologic	cal Waste Treatment
Тур	Project-/problem-based Learning
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	 Introduction biological basics determination process specific material characterization aerobic degradation (Composting, stabilization) anaerobic degradation (Biogas production, fermentation) Technical layout and process design Flue gas treatment Plant design practical phase
Literature	



Module M0705: 0	Groundwater				
Courses					
Title Geohydraulic and Solute Geohydraulic and Solute		Typ Lecture Recitation Section (small)	2	CP 2	
Simulation in Groundwate		Lecture	1	1	
Simulation in Groundwate		Recitation Section (small)	2	2	
Module Responsible	NN				
Admission Requirements	INANA				
Recommended Previous Knowledge	,				
Educational Objectives	After taking part successfully, students have	reached the following lea	rning results		
Professional Competence					
Knowledge	The students are able to describe the fate of solutes in the subsurface along the path between soil and water body quantitatively and qualitatively. They are able to do this with simulation models.				
Skills	The students are able to describe conceptually movement and storage of water in the unsaturated zone. They are able to analyse pF- functions and Ku functions. They can model transport of solutes in the unsaturated and saturated zoned. They are able to determine dispersiities, sorption coefficients, decay rates and dissolution rates for organic and inorganic substances.				
Personal Competence					
Social Competence	The students can help to each other.				
Autonomy	none				
Workload in Hours	Independent Study Time 96, Study Time in I	Lecture 84			
Credit points	6				
Studienleistung	None				
	Written exam				
Examination duration and scale	60 min written exam and written papers				
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Civil Engineering: Specialisation Geotechni Civil Engineering: Specialisation Coastal En Civil Engineering: Specialisation Water and Process Engineering: Specialisation Engineering Compulsory Process Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Process Water and Environmental Engineering: Specialisation Process	cal Engineering: Elective (ngineering: Elective Comp Traffic: Elective Compulso Environmental Process as Engineering: Elective Compulso cialisation Water: Compul cialisation Environment: E	Compulsory bulsory bry Engineering ompulsory sory		



Course L0539: Geohyd	draulic and Solute Transport
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wilfried Schneider
Language	DE
Cycle	WiSe
Content	Pump test analysis, water content-water suction functions, unsaturated hydraulic conductivity function, Brooks-Corey relation, van Genuchten relation, solute transport in unsaturated zone, solute transport and reactions in groundwater
Literature	Todd; K. (2005): Groundwater Hydrology Fetter, C.W. (2001): Applied Hydrogeology Hölting & Coldewey (2005): Hydrogeologie Charbeneau, R.J. (2000): Groundwater Hydraulics and pollutant Transport

Course L0540: Geohydraulic and Solute Transport				
Тур	Recitation Section (small)			
Hrs/wk	1			
СР	1			
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14			
Lecturer	Prof. Wilfried Schneider			
Language	DE			
Cycle	WiSe			
Content	See interlocking course			
Literature	See interlocking course			

Course L0541: Simula	tion in Groundwater Hydrology
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Schröter
Language	DE
Cycle	WiSe
Content	Basics and theoretical background of simulation models frequently used in science and practise for pumping test analysis, water movement in vadose zone, solute transport in vadose zone, groundwater recharge, solute transport in groundwater
Literature	Handbücher der verwendeten Slumationsmodelle werden bereitgestellt.



Course L0542: Simulation in Groundwater Hydrology				
Тур	Recitation Section (small)			
Hrs/wk	2			
СР	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Sonja Schröter			
Language	DE			
Cycle	WiSe			
Content	See interlocking course			
Literature	See interlocking course			



Module M0949: Rural Development and Resources Oriented Sanitation for different
Climate Zones

Courses						
Courses						
Title	Typ	Hrs/wk	СР			
Rural Development and Resources Oriented Sanitation for different Climate Seminar 2 3 Zones (L0942)						
Bural Development and Resources Oriented Sanitation for different Climate						
Zones (L0941)	Lecture	2	3			
Module Responsible	Prof. Ralf Otterpohl					
Admission Requirements	INone					
Recommended Previous Knowledge	I recourses and conitation	egradation,	lack of water			
Educational Objectives	I Affar taking nart cuccecetully, ctudente have reached the following lea	ırning resul	ts			
Professional						
Competence		noinly bass	nd on accorate			
	Students can describe resources oriented wastewater systems mainly based on source control in detail. They can comment on techniques designed for reuse of water, nutrients and soil conditioners.					
Knowledge	Students are able to discuss a wide range of proven approaches in Rural Development from and for many regions of the world.					
Skills	Students are able to design low-tech/low-cost sanitation, rural water supply, rainwater harvesting systems, measures for the rehabilitation of top soil quality combined with food and water security. Students can consult on the basics of soil building through "Holisitc Planned Grazing" as developed by Allan Savory.					
Personal						
Competence						
Social Competence	The students are able to develop a specific topic in a team and to work out milestones according to a given plan.					
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 Lecture 56	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6					
Studienleistung	None					
Examination	Subject theoretical and practical work					
Examination duration and scale	During the course of the semester, the students work towards mile stones. The work includes presentations and papers. Detailed information will be provided at the beginning of the smester.					
	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory Chemical and Bioprocess Engineering: Specialisation General Process Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Energy and Environmental Engineering: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory					



Assignment for the	Internatio	International Management and Engineering: Specialisation II. Energy and Environmental							
Following Curricula	Engineeri	Engineering: Elective Compulsory							
	Joint Euro	Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation							
	Water: Ele	Water: Elective Compulsory							
	Process	Process Engineering: Specialisation Environmental Process Engineering: Elective							
	Compulso	Compulsory							
	Process Engineering: Specialisation Process Engineering: Elective Compulsory								
	Water and Environmental Engineering: Specialisation Water: Elective Compulsory								
	Water and	Water and Environmental Engineering: Specialisation Environment: Elective Compulsory							
	Water and	d Environmenta	l Engineering: Sp	ecialisation Citie	s: Elective	Compulsory			

Course L0942: Rural D	Development and Resources Oriented Sanitation for different Climate Zones
Тур	Seminar
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 Central part of this module is a group work on a subtopic of the lectures. The focus of these projects will be based on an interview with a target audience, practitioners or scientists. The group work is divided into several Milestones and Assignments. The outcome will be presented in a final presentation at the end of the semester.
Literature	 J. Lange, R. Otterpohl 2000: Abwasser - Handbuch zu einer zukunftsfähigen Abwasserwirtschaft. Mallbeton Verlag (TUHH Bibliothek) Winblad, Uno and Simpson-Hébert, Mayling 2004: Ecological Sanitation, EcoSanRes, Sweden (free download) Schober, Sabine: WTO/TUHH Award winning Terra Preta Toilet Design: http://youtu.be/w_R09cYq6ys



Course L0941: Rural D	Development and Resources Oriented Sanitation for different Climate Zones
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 Living Soil - THE key element of Rural Development Participatory Approaches Rainwater Harvesting Ecological Sanitation Principles and practical examples Permaculture Principles of Rural Development Performance and Resilience of Organic Small Farms Going Further: The TUHH Toolbox for Rural Development EMAS Technologies, Low cost drinking water supply
Literature	 Miracle Water Village, India, Integrated Rainwater Harvesting, Water Efficiency, Reforestation and Sanitation: http://youtu.be/9hmkgn0nBgk Montgomery, David R. 2007: Dirt: The Erosion of Civilizations, University of California Press



Module M0822: P	Process Modeling in Water Techn	ology		
Courses				
Title		Тур	Hrs/wk	СР
	stewater Treatment (L0522)	Project-/problem-based Learning	2	3
Process Modeling in Drink	king Water Treatment (L0314)	Project-/problem-based Learning	2	3
Module Responsible	Dr. Klaus Johannsen			
Admission Requirements	None			
Recommended Previous Knowledge	Knowledge of the most important processes i	n drinking water and wa	ste water tr	eatment.
Educational Objectives	After taking part successfully, students have r	eached the following lea	arning resul	ts
Professional				
Competence Knowledge	Students are able to explain selected processes of drinking water and waste water treatment in detail. They are able to explain basics as well as possibilities and limitations of dynamic modeling.			
Skills	Students are able to use the most important features Modelica offers. They are able to transpose selected processes in drinking water and waste water treatment into a mathematical model in Modelica with respect to equilibrium, kinetics and mass balances. They are able to set up and apply models and assess their possibilities and limitations.			
Personal Competence			ala di salah s	
Social Competence	Students are able to solve problems and d different technical background. They are at constructively with feedback concerning their	ole to give appropriate		
Autonomy	Students are able to define a problem, gain the required knowledge and set up a model.			
Workload in Hours	Independent Study Time 124, Study Time in L	ecture 56		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	1,5 hours			
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory			



Course L0522: Proces	s Modelling of Wastewater Treatment		
Тур	Project-/problem-based Learning		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Dr. Joachim Behrendt		
Language	DE/EN		
Cycle	WiSe		
	Mass and energy balances		
	Tracer modelling		
	Activated Sludge Model		
Content	Wastewater Treatment Plant Modelling (continously and SBR)		
	Sludge Treatment (ADM, aerobic autothermal)		
	Biofilm Modelling		
Literature	Henze, Mogens (Seminar on Activated Sludge Modelling, ; Kollekolle Seminar on Activated Sludge Modelling, ;) Activated sludge modelling: processes in theory and practice; selected proceedings of the 5th Kollekolle Seminar on Activated Sludge Modelling, held in Kollekolle, Denmark, 10 - 12 September 2001 ISBN: 1843394146 [London]: IWA Publ., 2002 TUB_HH_Katalog Henze, Mogens Activated sludge models ASM1, ASM2, ASM2d and ASM3 ISBN: 1900222248 London: IWA Publ., 2002 TUB_HH_Katalog Henze, Mogens Wastewater treatment: biological and chemical processes ISBN: 3540422285 (Pp.) Berlin [u.a.]: Springer, 2002 TUB_HH_Katalog Wiesmann, Udo (Choi, In Su; Dombrowski, Eva-Maria;) Fundamentals of biological wastewater treatment ISBN: 3527312196 (Gb.) URL: http://deposit.ddb.de/cgi-bin/dokserv? id=2774611&prov=M&dok_var=1&dok_ext=htm Weinheim: WILEY-VCH, 2007 TUB_HH_Katalog		



Course L0314: Proces	s Modeling in Drinking Water Treatment
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen
Language	DE/EN
Cycle	WiSe
Content	In this course selected drinking water treatment processes (e.g. aeration or activated carbor adsorption) are modeled dynamically using the programming language Modelica, that is increasingly used in industry. In this course OpenModelica is used, an free access frontend of the programming language Modelica. In the beginning of the course, the use of OpenModelica is explaineded by means of simple examples. Together required elements and structure of the model are developed. The implementation in OpenModelica and the application of the model is done individually or in groups respectively. Students get feedback and can gain extra points for the exam.
Literature	OpenModelica: https://openmodelica.org/index.php/download/download-windows OpenModelica - Modelica Tutorial https://openmodelica.org/index.php/useresresources/userdocumentation OpenModelica - Users Guide https://openmodelica.org/index.php/useresresources/userdocumentation Peter Fritzson: Principles of Object-Oriented Modeling and Simulation with Modelica 2.1, Wiley-IEEE Press, ISBN 0-471-471631. MHW (rev. by Crittenden, J. et al.): Water treatment principles and design. John Wiley & Sons, Hoboken, 2005. Stumm, W., Morgan, J.J.: Aquatic chemistry. John Wiley & Sons, New York, 1996. DVGW (Hrsg.): Wasseraufbereitung - Grundlagen und Verfahren. Oldenbourg Industrie Verlag, München, 2004.



Module M0620: S	pecial Aspects of W	/aste Resourc	e Management		
Courses					
Title			Тур	Hrs/wk	СР
Advanced Topics in Wast	e Resource Management (L105	55)	Project-/problem-based Learning	3	3
International Waste Mana	gement (L0317)		Project-/problem-based Learning	2	3
Module Responsible	Prof. Kerstin Kuchta				
Admission Requirements	None				
Recommended Previous Knowledge	basics in waste treatment to	echnologies			
Educational Objectives	After taking part successfull	ly, students have re	eached the following lea	arning resul	ts
Professional Competence					
Knowledge	The students are able to describe waste as a resource as well as advanced technologies for recycling and recovery of resources from waste in detail. This covers collection, transport, treatment and disposal in national and international contexts.				
Skills	Students are able to select suitable processes for the treatment with respect to the national or cultural and developmental context. They can evaluate the ecological impact and the technical effort of different technologies and management systems.				
Personal Competence					
Social Competence	Students can work together as a team of 2-5 persons, participate in subject-specific and interdisciplinary discussions, develop cooperated solutions and defend their own work results in front of others and promote the scientific development of colleagues. Furthermore, they can give and accept professional constructive criticisms.				
Autonomy	Students can independently gain additional knowledge of the subject area and apply it in solving the given course tasks and projects.				
Workload in Hours	Independent Study Time 11	10, Study Time in Lo	ecture 70		
Credit points	6				
Studienleistung	•	Form Written elaboration	Description	on	
Examination	Presentation				
Examination duration and scale	PowerPoint presentation (1	0-15 minutes)			
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Environmental Engineering: Specialisation Waste and Energy: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Energy: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory				



Course L1055: Advanced Topics in Waste Resource Management		
Тур	Project-/problem-based Learning	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Rüdiger Siechau	
Language	EN	
Cycle	WiSe	
Content	Focus of the course "Advanced topics of waste resource management" lies on the organisational structures in waste management - such as planning, financing and logistics. One excursion will be offered to take part in (incineration plant, vehicle fleet and waste collection systems). The course is split into two parts: 1. part: "Conventional" lecture (development of waste management, legislation, collection, transportation and organisation of waste management, costs, fees and revenues). 2. part: Project base learning: You will get a project to work out in groups of 4 to 6 students; all tools and data you need to work out the project were given before during the conventional lecture. Course documents are published in StudIP and communication during project work takes place via StudIP. The results of the project work are presented at the end of the semester. The final mark for the course consists of the grade for the presentation.	
Literature	Einführung in die Abfallwirtschaft; Martin Kranert, Klaus Cord-Landwehr (Hrsg.); Vieweg + Teubner Verlag; 2010 PowerPoint slides in Stud IP	

Course L0317: Interna	tional Waste Management
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	Waste avoidance and recycling are the focus of this lecture. Additionally, waste logistics (Collection, transport, export, fees and taxes) as well as international waste shipment solutions are presented. Other specific wastes, e.g. industrial waste, treatment concepts will be presented and developed by students themselves Waste composition and production on international level, wast eulogistic, collection and treatment in emerging and developing countries. Single national projects and studies will be prepared and presented by students
Literature	Basel convention



Module M0713: C	Concrete Structures			
Courses				
Title		Тур	Hrs/wk	СР
Concrete Structures (L05		Seminar	1	1
Structural Concrete Meml Structural Concrete Meml		Lecture Recitation Section (large)	2	3 2
	· ,	hecitation Section (large)	2	2
	Prof. Günter Rombach			
Admission Requirements	None			
Do come me anada d	Basics of structural analysis, conce	ption and dimensioning of structur	al concrete	!
Recommended Previous Knowledge	Modules 'Concrete Structures I and	II'		
Educational Objectives	After taking part successfully, stude	nts have reached the following lea	arning resu	Its
Professional				
Competence				
Knowledge	The students broaden their skills in structural engineering, especially in the field of building (houses, roofs, halls). They dispose of the knowledge for the conception and design concrete buildings and structural members that are often used.			
Skills	The students are able to apply procedures of the conception and dimensioning to to practical problems of structural engineering. They are capable to draft concrete buildings and to design them for general action effects and to plan their detailing and execution. Moreover, they can make design and construction sketches and draw up technical descriptions.			
Personal				
Competence	The students are able to obtain rest	ulte of high quality in teamwork		
Social Competence	The students are able to obtain rest	ans of flight quality in learnwork.		
Autonomy	The students are able to carry out complex conception and dimensioning tasks of structures under the guidance of tutors.			
Workload in Hours	Independent Study Time 110, Study	y Time in Lecture 70		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	120 minutes			
_	Civil Engineering: Specialisation St Civil Engineering: Specialisation Good Civil Engineering: Specialisation Cookid Engineering: Specialisation Working International Management and E	eotechnical Engineering: Elective oastal Engineering: Elective Comp ater and Traffic: Elective Compuls	Compulsor oulsory ory	

Compulsory



Course L0579: Concre	ete Structures
Тур	Seminar
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	With help of a project teamwork the subjects of the course "Concrete Structures" is practiced, discussed and presented.
Literature	- Projektbezogene Unterlagen werden abgegeben.

Course L0577: Structu	iral Concrete Members
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 concrete buildings actions on structrues bracing systems slabs (line and point supported plates and floor slabs) membranes and deep beams shells and folded plates reinforced and prestressed members
Literature	- Vorlesungsunterlagen

Course L0578: Structural Concrete Members		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0722: Computational Analysis of Concrete Structures				
Courses				
-	Concrete Structures (L0598) Concrete Structures (L0599)	Typ Lecture Recitation Section (large) Project-/problem-based	Hrs/wk 2 2	CP 2 2
FE-Modeling of Concrete	Structures (L0600)	Learning	2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	None			
Recommended	Basic knowledge in structural analysis and c slabs, shear walls). Lectures 'Concrete Structures I und II'	lesign of reinforced con	crete struct	ures (beams,
Previous Knowledge	Lectures 'Structural Analysis I and II' Lecture 'Concrete Structures'			
Educational Objectives	After taking part successfully, students have re	eached the following lea	rning result	S
Professional Competence	The students know the problems of numerical modeling and design of an arbitrary concrete			
Knowledge Skills	structure. The students can model and design an arbitrary concrete structure by means of a finite element software package.			
Personal Competence				
Social Competence	The students can model and design in teamwork a real concrete structure by means of a finite element software package.			
Autonomy	The students can model and design a real concrete structure based on a finite element software package and discuss the problems and results with other students.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points				
Studienleistung				
Examination Examination duration and scale				
_	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Water and Traffic: Elective Compulsory			



Course L0598: Computational Analysis of Concrete Structures	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 Modeling of beam and truss structures Discontinuity regions, like frame corners, openings, shear walls with large openings Bracing of high-rise buildings Modeling of bridges Nonlinear analysis Finite-Elemente-analysis of slabs: support conditions, singularity regions Finite-Elemente-Berechnungen of shear walls and deep beams: support condition, design Coupled systems Modeling of slab supported on beams Shell structures 3D building models Nonlinear analysis of slabs and shells Documentation
Literature	 Vorlesungsumdruck Rombach, G.A. (2007): Anwendung der Finite-Elemente-Methode im Betonbau. 2. Auflage, Verlag Ernst & Sohn, Berlin Rombach G.A. (2011): Finite-Element Design of Concrete Structures, 2nd edition, ICE publishing Hartmann, F., Katz, C. (2002): Statik mit finiten Elementen. Springer, Berlin

Course L0599: Computational Analysis of Concrete Structures	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L0600: FE-Mod	Course L0600: FE-Modeling of Concrete Structures	
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Lukas Henze	
Language	DE	
Cycle	WiSe	
Content	Finite Element Modeling and computational design of concrete structures by 'SOFiSTiK'	
Literature	 Rombach G.: Anwendung der Finite - Elemente - Methode im Betonbau. 2. Auflage. Verlag Ernst &.Sohn, Berlin, 2007 Rombach G.: Finite-Element Design of Concrete Structures. 2nd edition, ICE Publishing, London, 2011, ISBN 0 7277 32749 Rombach G.: EDV-unterstützte Berechnungen im Stahlbetonbau. in: "Stahlbetonbau aktuell 2014" (ed. Gorris A., Hegger J., Mark P.), Berlin 2014 (S. C1C.36) 	



Module M0963: Steel and Composite Structures				
Courses				
Title Steel and Composite Struc	ctures (I 1204)	Typ Lecture	Hrs/wk C	;P
Steel and Composite Struct Steel Bridges (L1097)		Recitation Section (large) Lecture		
Module Responsible	Prof. Marcus Rutner			
Admission Requirements	None			
Recommended Previous Knowledge	Basics of steel construction (i.e. Steel Structu	res I and II, BUBC)		
Educational Objectives	After taking part successfully, students have	reached the following lea	rning results	
Professional Competence				
Knowledge	 describe the phenomenon of local buckling explain warping torsion illustrate the behaviour of composite structures specify the principles in design of composite structures sketch the contructions of steel and composite bridges 			
Skills	After successful participation students are able to check stiffened and unstiffened plated structures recognize and verify warping tosion in strucures design composite structures design bridges and o perform the detailing			
Personal Competence				
Social Competence				
Autonomy				
-	Independent Study Time 96, Study Time in L	ecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration and scale	180 min			
_	Civil Engineering: Specialisation Structural E Civil Engineering: Specialisation Geotechnic Civil Engineering: Specialisation Coastal En Civil Engineering: Specialisation Water and International Management and Engineerin Compulsory	cal Engineering: Elective gineering: Elective Comp Traffic: Elective Compulso	Compulsory oulsory ory	g: Electiv



Course L1204: Steel and Composite Structures	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	WiSe
Content	 Local-buckling of plated structures Warping torsion Composite-girders, -columns, -slabs, -bridges Principles in composite constructions Bridge-design and -construction
Literature	Petersen, C.: Stahlbau, 4.Auflage 2013, Springer-Vieweg Verlag Minnert, J. Wagenknecht, G.: Verbundbau-Praxis - Berechnung und Konstruktion nach Eurocode 4, 2.Auflage 2013, Bauwerk Beuth Verlag

Course L1205: Steel and Composite Structures	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



urse L1097: Steel B	ridges
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
	Dr. Jörg Ahlgrimm
Language	
Cycle	WiSe Lecture Contents ,Steel Bridge Construction' DrIng. Jörg Ahlgrimm
	- From tendering and contracting to completion - the development of a steel bridge
	- Contents of a bridge static - structural details, examples of analysis in detail:
	-> effective width in regard to the longitudinal stiffeners
	-> Bearing point, bearing stiffener
	-> Crossbeam breakthrough, crossbeam reinforcement
	-> Analysis of the Rib-to-Floorbeam (RF) connection (web-tooth of the floorbeam betwee trapezoidal shaped Ribs)
Content	- Steel grades, -designation, testing methods and approval certificates
	- Nondestructive weld inspecting
	- Corrosion protection
	- Bridge bearing - types, format, function, dimensioning, installation
	- Expansion Joints
	- Oscillation of bridge hangers and cables - oscillation damper
	- Opening bridges- Detailed reviews to different assembling procedures and - implements
	- Selective damage events
	Requirements: Basic knowledge in the calculation, dimensioning, and construction of structural elements and joints of constructional steelwork
Literature	 Herbert Schmidt, Ulrich Schulte, Rainer Zwätz, Lothar Bär: Ausführung von Stahlbauten Petersen, Christian: Stahlbau, Abschnitt Brückenbau
	 Ahlgrimm, J., Lohrer, I.: Erneuerung der Eisenbahnüberführung in Fulda-Horas üb die Fulda, Stahlbau 74 (2005), Heft 2, S. 114



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Courses			
Title	Тур	Hrs/	
Analysis of Offshore Struc		1	1
Design of Concrete Struc		2	2
=	concrete Structures (L0596) Lecture	1	1
=	concrete Structures (L0597) Recitation Section		1
	d Construction Management (L1634) Seminar	1	1
	nd Construction Management (L1635) Seminar	1	1
Timber Structures (L1151		2	2
Glass Structures (L1152)		2	2
Glass Structures (L1447)			1
Wind turbine design (L190	D5) Lecture	1	1
Module Responsible	Prof. Uwe Starossek		
Admission Requirements	None		
Recommended Previous Knowledge	none		
Educational Objectives	After taking part successfully, students have reached the follow	wing learning	results
Professional Competence			
Knowledge	 Students are able to find their way through selected special areas within civil and structural engineering. Students are able to explain basic models and procedures in selected special areas or civil and structural engineering. Students are able to interrelate scientific and technical knowledge. 		
Skills	 Students are able to apply basic methods in selected areas of civil and structura engineering. 		
Personal Competence			
Social Competence			
Autonomy	 Students can chose independently, in which fields they want to deepen thei knowledge and skills through the election of courses. 		
	1		
Workload in Hours	Depends on choice of courses		

Civil Engineering: Specialisation Water and Traffic: Elective Compulsory

Following Curricula Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory



and scale Lecturer Dr. Said Fawad Mohammadi Language DE/EN Cycle SoSe Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Course L1867: Analysi	is of Offshore Structures
Workload in Hours Independent Study Time 16, Study Time in Lecture 14 Examination Form Mündliche Prüfung Examination duration and scale Lecturer Dr. Said Fawad Mohammadi Language DE/EN Cycle SoSe Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Тур	Lecture
Morkload in Hours Independent Study Time 16, Study Time in Lecture 14	Hrs/wk	1
Examination Form Mündliche Prüfung Examination duration 30 min Lecturer Dr. Said Fawad Mohammadi Language DE/EN Cycle SoSe Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	СР	1
Examination duration and scale Lecturer Dr. Said Fawad Mohammadi Language DE/EN Cycle SoSe Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
and scale Lecturer Dr. Said Fawad Mohammadi Language DE/EN Cycle SoSe Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Content Content Content Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Examination Form	Mündliche Prüfung
Cycle SoSe Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Examination duration and scale	30 min
Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Lecturer	Dr. Said Fawad Mohammadi
Topic 1: Types of Offshore Structures, Fixed and floating structures for Oil & Gas and Offshore Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Language	DE/EN
Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying techniques	Cycle	SoSe
		Wind industry Topic 2: Wave Forces, Morisons equation Topic 3: Irregular Seastates, Power spectrum and application of FFT Topic 4: Additional Environmental Forces, Wind spectra, current forces Topic 5: Linear-Time-Invariant Systems, Response of an LTI-system in frequency domain Topic 6: Tubular Welded Connections, Stress concentration factors, weld geometry Topic 7: Introduction to Fracture Mechanics, Criteria for fracture initiation and crack growth Topic 8: Time and Frequency Domain Fatigue Analyses, Rainflow Counting, application of LTI-systems for frequency domain fatigue Topic 9: Offshore Installation and Exam, Installation of structures, pile driving, pipe laying
Literature	Literature	

Course L1840: Design of Concrete Strucutures	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
	Mündliche Prüfung
Examination duration and scale	20 min
Lecturer	Dr. Karl Morgen
Language	DE
Cycle	WiSe
Content	
Literature	Schlaich/Schäfer, Konstruieren im Stahlbau, BetonKalender 2001, Tll, Verlag Ernst & Sohn



Course L0596: Design	of Prefabricated Concrete Structures
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 application and advantages and disadvantages of precast concrete structures basics of design - precast element production - construction - tolerances elements of a warehouse design of a beam - joints design of D-regions: half joints, corbels, openings slab types - walls - facades footings: pocket and block foundations joints - connections shear design of the interface between concrete cast at different times unreinforced concrete structures
Literature	 Bachmann H., Steinle A.; Hahn V.: Bauen mit Betonfertigteilen. Betonkalender 2009, Teil I, Verlag Ernst & Sohn, Berlin Bindseil P.: Stahlbetonfertigteile. Werner Verlag, 1998 FIP: FIP Handbuch für Planung und Entwerfen von Fertigteilbauten (siehe Zeitschrift: Beton- und Fertigteiltechnik ab 3/1996) Bergmeister K.: Konstruieren von Fertigteilen. Betonkalender 2005 Teil 2, S. 163-240 Reineck KH.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 Teil 2, S. 241-296 Graubner CA. et. al.: Bemessung von Fertigteilen nach DIN 1045-1. Betonkalender 2005 Teil 2, S. 297-374 Broschüren der Fachvereinigung Deutscher Betonfertigteilbau e.V. siehe: www.fdb-fertigteilbau.de www.systembauweise.de

Course L0597: Design of Prefabricated Concrete Structures		
Typ 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 scale	Siehe korrespondierende Vorlesung	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1634: Forum I - Geotechnics and Construction Management		
Тур	Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Examination Form		
Examination duration and scale	30 min	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	WiSe	
Content	Lectures about projects and issues with practical and scientific relevance.	
Literature		

Course L1635: Forum II - Geotechnics and Construction Management		
Тур	Seminar	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
	Mündliche Prüfung	
Examination duration and scale	30 min	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	SoSe	
Content	Lectures about projects and issues with practical and scientific relevance.	
Literature		

Course L1151: Timber Structures		
Тур	Seminar	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form		
Examination duration and scale	90 min	
Lecturer	Prof. Torsten Faber	
Language	DE	
Cycle	WiSe	
Content		
Literature		



Course L1152: Glass Structures				
Тур	Lecture			
Hrs/wk	2			
СР	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Examination Form				
Examination duration and scale	60 min			
Lecturer	Marvin Matzik			
Language				
Cycle				
Content	Glass structures - Introduction of the material glass (production, refinement, material characteristic) - design of facades - facade types - static calculation of glazing - static calculation of facades - load bearing behavior of glazing (plate or membrane stiffness) - vertical / horizontal glazing with safety-related requirements - glass structures - fire safety of glass facades - construction physics of facades and glazing			
Literature				

Course L1447: Glass Structures		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Examination Form		
Examination duration and scale	60 min	
Lecturer	Marvin Matzik	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1905: Wind turbine design		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
	Mündliche Prüfung	
Examination duration and scale	30 min	
Lecturer	Dr. Jörn Scheller	
Language	DE	
Cycle	SoSe	
Content		
Literature		



Module M0699: A	dvanced F	oundati	on Engir	neering	and Soil Lal	ooratory Co	ourse
Courses							
Title					Тур	Hrs/wk	СР
Soil Laboratory Course (L	•				Practical Course	1	2
Advanced Foundation Eng	:				Lecture	2	2
Advanced Foundation Eng	gineering (L0498)				Recitation Section (large) 1	2
Module Responsible	Prof. Jürgen Gı	rabe					
Admission Requirements	Nono						
Recommended Previous Knowledge							
Educational Objectives	After taking par	rt successfu	ully, student	s have rea	ached the followin	ıg learning resu	Its
Professional Competence							
Knowledge	ĺ						
Skills	İ						
Personal	ĺ						
Competence							
Social Competence							
Autonomy							
Workload in Hours	Independent S	tudy Time	124, Study T	Time in Le	cture 56		
Credit points	6						
	Compulsory E	Bonus	Form		Desc	ription	
Studienleistung	Yes N	lone	Subject practical w	theoreti ork	cal and		
Examination	Written exam						
Examination duration and scale	I KII MIN						
Assignment for the Following Curricula	Civil Engineeri Civil Engineeri Civil Engineeri	ng: Specia ng: Specia ng: Specia	lisation Geo lisation Coa lisation Wat	technical stal Engir er and Tra		mpulsory ory npulsory	ering: Elective



Course L0499: Soil Laboratory Course				
Тур	ractical Course			
Hrs/wk				
СР	2			
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14			
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 L0497: Advanced Foundation Engineering				
Тур	ecture			
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	 Vertical drains Piles Ground improvement (Deep Compaction, Soil mixing) Vibration driving Jet grouting Slurry wall Deep excavation 			
Literature	 EAK (2002): Empfehlungen für Küstenschutzbauwerke EAU (2004): Empfehlungen des Arbeitsausschusses Uferbauwerke EAB (1988): Empfehlungen des Arbeitskreises Baugruben Grundbau-Taschenbuch, Teil 1-3, (1997), Ernst & Sohn Verlag 			



Course L0498: Advanced Foundation Engineering		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1401: S	Study work Water and Traffic			
Courses				
Title	Typ Hrs/wk CP			
Module Responsible	Dozenten des SD B			
Admission Requirements	INone			
Recommended Previous Knowledge	Subjects of the Water Management and Waste specialisation.			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	The students are able to demonstrate their detailed knowledge in the field of water management and waste. They can exemplify the state of technology and application and discuss critically in the context of actual problems and general conditions of science and society. The students can develop solving strategies and approaches for fundamental and practical problems in the field of water management and waste. They may apply theory based procedures and integrate safety-related, ecological, ethical, and economic view points of science and society. Scientific work techniques that are used can be described and critically reviewed.			
Skills	The students are able to independently select methods or planning approaches for the project work and to justify their choice. They can explain how these methods or approaches relate to solutions in the field of work and how the context of application has to be adjusted. General findings and further developments may essentially be outlined.			
Personal				
Competence				
Social Competence	The students are able to condense the relevance and the structure of the project work, the work steps and the sub-problems for the presentation and discussion in front of a bigger group. They can lead the discussion and give a feedback on the project to their colleagues.			
Autonomy	The students are capable of independently planning and documenting the work steps and procedures while considering the given deadlines. This includes the ability to accurately procure the newest scientific information. Furthermore, they can obtain feedback from experts with regard to the progress of the work, and to accomplish results on the state of the art in science and technology.			
Workload in Hours	Independent Study Time 180, Study Time in Lecture 0			
Credit points	6			
Studienleistung	None			
Examination	Study work			
Examination duration and scale	ISEE ESPO			
Assignment for the Following Curricula				



Module M0864: P	Practical Course in Water and	Wastewater Techn	ology		
Courses					
Title		Тур	Hrs/wk	СР	
	and Wastewater Technology I (L0503)	Practical Course	2	3	
Practicle Course of Waste	ewater Technology II (L0607)	Practical Course	3	3	
Module Responsible	Dr. Dorothea Rechtenbach				
Admission Requirements	None				
Recommended Previous Knowledge	Basic knowledge in chemistry and phys	ics (knowledge acquired a	t school)		
Educational Objectives	After taking part successfully, students h	ave reached the following	learning resu	Its	
Professional					
Competence					
Knowledge	The students know basic analytical procedures for evaluating the quality of water and wastewater. They have knowledge about fundamental process engineering features of important water and wastewater treatment technologies.				
Skills	The students are able to understand and to practically apply methodologies for wastewater analysis as well as descriptions of experiments and experimental setups in wastewater technology.				
Personal					
Competence					
Social Competence					
Autonomy	The students are able to conduct expeassistance.	eriments following written p	oroceaures w	itnout external	
Workload in Hours	Independent Study Time 110, Study Tim	ne in Lecture 70			
Credit points	6				
Studienleistung	None				
Examination	Written elaboration				
Examination duration and scale	ca. 5 Stunden				
_	Civil Engineering: Specialisation Water Water and Environmental Engineering: Water and Environmental Engineering: Water and Environmental Engineering:	Specialisation Water: Elec Specialisation Environmer	tive Compulsont: Elective Co	mpulsory	



Course L0503: Practical Course in Water and Wastewater Technology I		
Тур	Practical Course	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Dorothea Rechtenbach	
Language	DE/EN	
Cycle	WiSe	
Content	 Impact of pretreatment of wastewater samples on analytical results Analysis of nutrients in wastewater samples (different methods for nitrate analysis) Alkalinity TOC, COD microscopic analysis of microorganisms relevant in wastewater treatment 	
Literature	Skript auf StudIP	

Course L0607: Practic	ourse L0607: Practicle Course of Wastewater Technology II		
Тур	Practical Course		
Hrs/wk	3		
СР	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Lecturer	Dr. Joachim Behrendt		
Language	DE/EN		
Cycle	WiSe		
Content	Experiments: Oxygen transfer Oxygen Uptake rate Sludge dewatering Tracer Flocculation		
Literature	Skript/Script		



Module M0581: V				
Courses				
Title		Тур	Hrs/wk	СР
	stewater Management (L0226) stewater Management (L2008)	Lecture Project Seminar	3 3	3 3
Module Responsible		r roject cermiai	-	-
Admission				
Requirements	None			
Recommended Previous Knowledge	Good knowledge of wastewa	rainage;	and their prope	rties;
Educational Objectives	After taking part successfully, studer	nts have reached the following	g learning resu	Its
Professional				
Competence		eic principles of the regulate	ory framowork	related to th
Knowledge	The students can describe the basic principles of the regulatory framework related to the international and European water sector. They can explain limnological processes, substance cycles and water morphology in detail. They are able to assess complex problems related to water protection, such as ecosystem service and wastewater treatment with a special focus on innovative solutions, remediation measures as well as conceptual approaches.			
Skills	Students can accurately assess cur context. They can suggest concrete water cycle. Furthermore, they legislative solutions to solve these p	e actions to contribute to the potential can suggest appropriate te	planning of tom	norrow's urba
Personal				
Competence				
	The students can work together in ir	nternational groups.		
Social Competence				
Coolai Competence				
	Students are able to organize their can acquire appropriate knowledge			cussions. The
Autonomy				
, i.e.e				
Workload in Hours	Independent Study Time 96, Study	Time in Lecture 84		
Credit points	6			
Studienleistung	None			
Examination	Written exam			
Examination duration	160 min			
and scale				



	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Geotechnical Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory				
	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory				
	Environmental Engineering: Specialisation Water: Elective Compulsory				
	International Management and Engineering: Specialisation II. Civil Engineering: Elective				
Following Curricula	Compulsory				
	Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation				
	Water: Elective Compulsory				
	Water and Environmental Engineering: Specialisation Cities: Elective Compulsory				
	Water and Environmental Engineering: Specialisation Water: Elective Compulsory				
	Water and Environmental Engineering: Specialisation Environment: Compulsory				

Course L0226: Water I	Protection and Wastewater Management
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	 Regulatory Framework (e.g. WFD) Main instruments for the water management and protection In depth knowledge of relevant measures of water pollution control Urban drainage, treatment options in different regions on the world Rainwater management, improved management of heavy rainfalls, downpours, rainwater harvesting, rainwater infiltration Case Studies and Field Trips
Literature	 The literature listed below is available in the library of the TUHH. Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International. Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011) New York, NY: McGraw-Hill. Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Course L2008: Water Protection and Wastewater Management		
Тур	Project Seminar	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Ralf Otterpohl	
Language	EN	
Cycle	WiSe	
Content		
Literature		



Courses				
Title		Тур	Hrs/wk	СР
Membrane Technology (L	.0399)	Lecture	2	3
Membrane Technology (L	•	Recitation Section (small)		2
Membrane Technology (L	.0401)	Practical Course	1	1
Module Responsible				
Admission Requirements	INONA			
Recommended Previous Knowledge	and atoom trootmont	edge of the core processe	es involved	d in water, ga
Educational Objectives	After taking part successfully, students have	reached the following lea	rning resu	lts
Professional				
Competence				
Knowledge	Students will be able to rank the technical processes. They will be able to explain the consequence separation processes. Students will be able and their advantages and disadvantages. Stin the use of membranes in water, other liquing	different driving forces be to name materials use tudents will be able to ex	hind existi d in memb plain the k	ng membrar orane filtratio ey difference
Skills	Students will be able to prepare mathematic solution-diffusion membranes and calculate process. They will be able to handle technical data and provide recommendations for the Through their own experiments, students will filtration characteristics and application of diffusion characterise the formation of the foulin measures to control this.	e key parameters in the al membrane processes u he sequence of differer vill be able to classify the fferent membrane materia	e membra using availa nt treatme ne separat als. Studen	ne separation in the separation of the separatio
Personal				
Competence Social Competence	Students will be able to work in diverse tear	in their group on labora		-
Autonomy	Students will be in a position to solve ho independently. They will be capable of finding	-		
Workload in Hours	Independent Study Time 124, Study Time in	Lecture 56		
Credit points	6			
Studienleistung	None			
	Written exam			
Examination duration and scale	90 min			
	Civil Engineering: Specialisation Water and Bioprocess Engineering: Specialisation A Compulsory Bioprocess Engineering: Specialisation B Compulsory Chemical and Bioprocess Engineering: Elective Compulsory	- General Bioprocess	Enginee Enginee	ring: Electiv



	Compuls	sory								
Assignment for the	Energy	and	Environmer	ntal Engineer	ing:	Specialisation	on Energ	y and	Envir	onmental
Following Curricula	Enginee	ring: E	lective Com	oulsory						
	Environn	nental	Engineering	: Specialisatio	n Wat	ter: Elective (Compulsor	y		
	Joint Eu	ropea	n Master in	Environmenta	Stuc	dies - Cities	and Susta	inability	: Spec	ialisation
	Water: E	lective	Compulsory	/						
	Process	Eng	ineering: S	Specialisation	Envi	ironmental	Process	Engine	ering:	Elective
	Compuls	sory								

Process Engineering: Specialisation Process Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory

Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0399: Membr	ane Technology
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Mathias Ernst
Language	EN
Cycle	WiSe
Content	The lecture on membrane technology supply provides students with a broad understanding of existing membrane treatment processes, encompassing pressure driven membrane processes, membrane application in electrodialyis, pervaporation as well as membrane distillation. The lectures main focus is the industrial production of drinking water like particle separation or desalination; however gas separation processes as well as specific wastewater oriented applications such as membrane bioreactor systems will be discussed as well. Initially, basics in low pressure and high pressure membrane applications are presented (microfiltration, ultrafiltration, nanofiltration, reverse osmosis). Students learn about essential water quality parameter, transport equations and key parameter for pore membrane as well as solution diffusion membrane systems. The lecture sets a specific focus on fouling and scaling issues and provides knowledge on methods how to tackle with these phenomena in real water treatment application. A further part of the lecture deals with the character and manufacturing of different membrane materials and the characterization of membrane material by simple methods and advanced analysis. The functions, advantages and drawbacks of different membrane housings and modules are explained. Students learn how an industrial membrane application is designed in the succession of treatment steps like pre-treatment, water conditioning, membrane integration and post-treatment of water. Besides theory, the students will be provided with knowledge on membrane demo-site examples and insights in industrial practice.
Literature	 T. Melin, R. Rautenbach: Membranverfahren: Grundlagen der Modul- und Anlagenauslegung (2., erweiterte Auflage), Springer-Verlag, Berlin 2004. Marcel Mulder, Basic Principles of Membrane Technology, Kluwer Academic Publishers, Dordrecht, The Netherlands Richard W. Baker, Membrane Technology and Applications, Second Edition, John Wiley & Sons, Ltd., 2004



Course L0400: Membrane Technology		
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Mathias Ernst	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0401: Membrane Technology		
Тур	Practical Course	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Mathias Ernst	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Thesis

Module M-002: Master Thesis			
Courses Title	Тур	Hrs/wk	СР
	Professoren der TUHH	1113/WR	01
Admission Requirements	According to General Regulations §21 (1):		
Recommended Previous Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	 The students can use specialized knowledge (facts, theories, and methods) of their subject competently on specialized issues. The students can explain in depth the relevant approaches and terminologies in one or more areas of their subject, describing current developments and taking up a critical position on them. The students can place a research task in their subject area in its context and describe and critically assess the state of research. 		
Skills	 To select, apply and, if necessary, develop further methods that are suitable for solving the specialized problem in question. To apply knowledge they have acquired and methods they have learnt in the course of their studies to complex and/or incompletely defined problems in a solution-oriented way. To develop new scientific findings in their subject area and subject them to a critical assessment. 		
Personal Competence			
Social Competence	 Both in writing and orally outline a scientific issue understandably and in a structured way. Deal with issues competently in an expert discuss that is appropriate to the addressees while uphoviewpoints convincingly. 	sion and answer them	in a manner
Autonomy	Students are able: To structure a project of their own in work packages To work their way in depth into a largely unk information required for them to do so.		

	To apply the techniques of scientific work comprehensively in research of their own.	
Workload in Hours	Independent Study Time 900, Study Time in Lecture 0	
Credit points	30	
Studienleistung	None	
Examination	Thesis	
Examination duration and scale	According to General Regulations	
Assignment for the Following Curricula	Civil Engineering: Thesis: Compulsory Bioprocess Engineering: Thesis: Compulsory Chemical and Bioprocess Engineering: Thesis: Compulsory Computer Science: Thesis: Compulsory Electrical Engineering: Thesis: Compulsory Energy and Environmental Engineering: Thesis: Compulsory Energy Systems: Thesis: Compulsory Environmental Engineering: Thesis: Compulsory Environmental Engineering: Thesis: Compulsory Aircraft Systems Engineering: Thesis: Compulsory Global Innovation Management: Thesis: Compulsory Computational Science and Engineering: Thesis: Compulsory Computational Science and Engineering: Thesis: Compulsory Information and Communication Systems: Thesis: Compulsory International Production Management: Thesis: Compulsory International Management and Engineering: Thesis: Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Thesis: Compulsory Logistics, Infrastructure and Mobility: Thesis: Compulsory Materials Science: Thesis: Compulsory Mathematical Modelling in Engineering: Theory, Numerics, Applications: Thesis: Compulsory Mechanical Engineering and Management: Thesis: Compulsory Mechanical Engineering: Thesis: Compulsory Microelectronics and Microsystems: Thesis: Compulsory Product Development, Materials and Production: Thesis: Compulsory Renewable Energies: Thesis: Compulsory Naval Architecture and Ocean Engineering: Thesis: Compulsory Ship and Offshore Technology: Thesis: Compulsory Process Engineering: Thesis: Compulsory Process Engineering: Thesis: Compulsory Water and Environmental Engineering: Thesis: Compulsory	