Module Manual

Master of Science (M.Sc.)

Civil Engineering

Cohort: Winter Term 2019

Updated: 27th January 2023

Table of Contents

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 independend 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: 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

Course L1486: Business Model Generation & Green Technologies

Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	0
Lecturer	Prof. Michael Prange
Language	EN
Cycle	WiSe
Content	• Overview about Green Technologies • Introduction to Business Model Generation • Business model patterns • Design techniques for business ideas • Strategy development • Value proposition architecture • Business plan and financing • Component-based foundations • Lean Entrepreneurship Based on examples and case studies primarily in the field of green technologies, students learn the basics of Business Model Generation and will be able to develop business models and to evaluate start-up projects.
Literature	Präsentationsfolien, Beispiele und Fallstudien aus der Vorlesung Presentation slides, examples and case studies from the lecture

Course L1487: Corporate Entrepreneurship & Green Innovation	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Klausur
Examination duration and scale	
Lecturer	Prof. Michael Prange
Language	EN
Cycle	WiSe
Content	• Overview about Green Innovation • Introduction to Corporate Entrepreneurship • Entrepreneurial thinking in established companies • Entrepreneurs and managers • Strategic innovation processes • Corporate Venturing • Product Service Systems • Open Innovation • User Innovation Based on examples and case studies primarily in the field of green innovation, students learn the basics of corporate entrepreneurship and will be able to implement entrepreneurial thinking in established companies and to describe strategic innovation processes.
Literature	Präsentationsfolien, Beispiele und Fallstudien aus der Vorlesung Presentation slides, examples and case studies from the lecture

Course L1280: Creation of Business Opportunities	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Examination Form	Referat
Examination duration and scale	30 Minuten
Lecturer	Prof. Christoph Ihl
Language	EN
Cycle	SoSe
Content	Important note: This course is part of an 6 ECTS module consisting of two courses "Entrepreneurship" & "Creation of Business Opportunities", which have to be taken together in one semester. Startups are temporary, team-based organizations, which can form both within and outside of established companies, to pursue one central objective: taking a new venture idea to market by designing a business model that can be scaled to a full-grown company. In this course, students will form startup teams around self-selected ideas and run through the process just like real startups would do in the first three months of intensive work. Startup Engineering takes an incremental and iterative approach, in that it favors variety and alternatives over one detailed, linear five-year business plan to reach steady state operations. From a problem solving and systems thinking perspective, student teams create different possible versions of a new venture and alternative hypotheses about value creation for customers and value capture vis-à-vis competitors. We will draw on recent scientific findings about international success factors of new venture design. To test critical hypotheses early on, student teams engage in scientific, evidence-based, experimental trial-and-error learning process that measures real progress. Upon completion of this course, students will be able to: · Apply a modern innovation toolkit relevant in both the corporate & startup world · Analyze given business opportunities in terms of its constituent elements · Design new business models by gathering and combining relevant ideas, facts and information · Evaluate business opportunities and derive judgment about next steps & decisions Course language is English, but participants can decide to give their graded presentations in German. Students are invited to apply to this course module already with a startup idea and/ or team, but this is not a requirement! We will form teams and ideas in the beginning of the course. Class meetings have alternate intervals of lecture inputs, teamwork, mentoring, and peer feedback. Attendance is mandatory for at least 80% of class time due to large proportion of teamwork sessions. Student teams give three presentations and submit them with backup analyses. Grading scheme: · Startup discovery presentation after 5 weeks: 30% · Startup validation presentation after 10 weeks: 30% · Final startup pitches after 13 weeks: 40%
Literature	• Blank, S. & Dorf, B. (2012). The startup owner's manual. • Gans, J. & Stern, S. (2016). Entrepreneurial Strategy. • Osterwalder, A. & Yves, P. (2010). Business model generation. • Maurya, A. (2012). Running lean: Iterate from plan A to a plan that works. • Maurya, A. (2016). Scaling lean: Mastering the Key Metrics for Startup Growth. • Wilcox, J. (2016). FOCUS Framework: How to Find Product-Market Fit.

Course L2348: Drivers of success for projects	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	0
Lecturer	Lucia Pohl
Language	DE
Cycle	WiSe/SoSe
Content	
Literature	

Course L1384: Intellectual Property	
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	
Lecturer	Janna Thomsen, Cathérine Elkemann
Language	DE
Cycle	WiSe
Content	• Trademark law • Copyright • Patent law • Know-how, supplementary performance protection, et al. • Enforcement of intellectual property rights • Licensing of intellectual property rights • Hypothecation, security assignment and evaluation of intellectual property rights
Literature	Quellen und Materialen wird im Internet zur Verfügung gestellt

Course L2347: Human resource management for engineers	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	0
Lecturer	Helge Kochskämper
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1711: Innovation Debates	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Fachtheoretisch-fachpraktische Arbeit
Examination duration and scale	3 Präsentationen der schriftlichen Ausarbeitung à 20 Minutes
Lecturer	Prof. Daniel Heiner Ehls
Language	EN
Cycle	WiSe
Content	Scientific knowledge grows continuously but also experiences certain alignments over time. For example, early cultures had the believe of a flat earth while latest research has a spherical earth model. Also in social science and business management, from time to time certain concepts that have even been the predominant paradigm are challenged by new observations and models. Consequently, certain controversies emerge and build the base for advancing theory and managerial practice. With this lecture, we put ourselves in the middle of heated debates for informed academics and practitioners of the day after tomorrow. The lecture targets several controversies in the domain of technology strategy and innovation management. By the classical academic method and the novel problem based learning format of a structured discussion, a given controversy is scrutinized. On selected topics, students will discuss a dispute and gain a thorough understanding. Specifically, based on a brief introduction of a motion, a affirmative constructive as well as a negative constructive is presented by two different student groups. Each presentation is followed by a response of the other group and questions from the class. Topics range from latest theories and concepts for value capture, to the importance of operating within a global marketplace, to cutting edge approaches for innovation stimulation and technology management. Consequently, this lecture deepens the knowledge in technology strategy and innovation management (TIM), enables a critical thinking and thought leadership.
Literature	1. Course notes and materials provided before the lecture 2. Leiblein/ Ziedonis (2011): Technology Strategy and innovation management. Edward Elgar Publishing Ltd (optional)

Course L0940: Innovation Management	
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	
Lecturer	Prof. Cornelius Herstatt
Language	DE/EN
Cycle	SoSe
Content	Innovation is key to corporate growth and sustainibility. In this lecture Prof. Herstatt presents a systematic way from generating ideas to the successful implementation of innovations. **The lecture is presented in German language only**
Literature	• Goffin, K., Herstatt, C. and Mitchell, R. (2009): Innovationsmanagement: Strategie und effektive Umsetzung von Innovationsprozessen mit dem Pentathlon-Prinzip, München: Finanzbuch Verlag **Weiterführende Literatur** • Innovationsmanagement Juergen Hauschildt • F + E Management Specht, G. / Beckmann, Chr. • Management der frühen Innovationsphasen Cornelius Herstatt, Birgit Verworn (im TUHH-Intranet auch als E-Book verfügbar) • Bringing Technology and Innovation Into the Boardroom • weitere Literaturempfehlungen auf Anfrage

Course L0161: Internationalization Strategies	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	20-30 Minuten Referat einschl. Diskussionsleitung plus schriftliche Ausarbeitung (ca. 10 Seiten)
Lecturer	Prof. Thomas Wrona
Language	EN
Cycle	SoSe
Content	• Introduction • Internationalization of markets • Measuring internationalization of firms • Target market strategies • Market entry strategies • Timing strategies • Allocation strategies • Working in small teams on close-to-reality problems based on presented theories • Paper writing on developed solution to the given problem/project e.g. market attractiveness analysis; development of market entry strategy for a hypothetical product in a given region
Literature	• Bartlett/Ghoshal (2002): Managing Across Borders, The Transnational Solution, 2nd edition, Boston • Buckley, P.J./Ghauri, P.N. (1998), The Internationalization of the Firm, 2nd edition • Czinkota, Ronkainen, Moffett, Marinova, Marinov (2009), International Business, Hoboken • Dunning, J.H. (1993), The Globalization of Business: The Challenge of the 1990s, London • Ghoshal, S. (1987), Global Strategy: An Organizing Framework, Strategic Management Journal, p. 425-440 • Praveen Parboteeah, K.,Cullen, J.B. (2011) , Strategic International Management, International 5th Edition • Rugman, A.M./Collinson, S. (2012): International Business, 6th Edition, Essex 2012

Course L2350: Leadership	
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	Dr. Thomas Kosin
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1231: Management and Leadership	
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 Minuten
Lecturer	Prof. Christian Ringle
Language	DE
Cycle	SoSe
Content	• definitions and foundations of strategic management • strategic planning • strategic analysis and forecast • development of strategic options • strategy evaluaton, implementation and strategic control
Literature	- Bea, F.X.; Haas, J.: Strategisches Management, 5. Auflage, Stuttgart 2009. - Dess, G. G.; Lumpkin, G. T.; Eisner, A. B.: Strategic management: Creating competitive advantages, Boston 2010 - Hahn, D.; Taylor, B.: Strategische Unternehmensplanung: Strategische Unternehmensführung, 9. Auflage, Heidelberg 2006. - Hinterhuber, H.H.: Strategische Unternehmensführung Bd. 1: Strategisches Denken, 7. Aufl., Berlin u. a. 2004 - Hinterhuber, H.H.: Strategische Unternehmensführung Bd. 2: Strategisches Handeln, 7. Aufl., Berlin u. a. 2004 - Hungenberg, H.: Strategisches Management in Unternehmen, 6. Auflage, Wiesbaden 2011 - Johnson, G.; Scholes, K.; Whittington, R.: Strategisches Management. Eine Einführung, 9. Auflage, München 2011 - Macharzina, K.: Unternehmensführung: Das internationale Managementwissen, 7. Auflage, Wiesbaden 2010. - Porter, M.E.: Competitive strategy, New York 1980 (deutsche Ausgabe: Wettbewerbsstrategie, 10. Aufl., Frankfurt am Main 1999) - Welge, M. K.; Al-Laham, A.: Strategisches Management, 5. Auflage, Wiesbaden 2008.

Course L1857: Entrepreneurial Management	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	20 Minuten inklusive 15 Seiten Ausarbeitung
Lecturer	Prof. Christoph Ihl
Language	EN
Cycle	WiSe
Content	Important note: This course is part of an 6 ECTS module consisting of the three courses "Startup Engineering", "Startup Engineering Project" and "Entrepreneurship Management", which have to be taken together in one semester. Startups are temporary, team-based organizations, which can form both within and outside of established companies, to pursue one central objective: taking a new venture idea to market by designing a business model that can be scaled to a full-grown company. In this course, students will form startup teams around self-selected ideas and run through the process just like real startups would do in the first three months of intensive work. Startup Engineering takes an incremental and iterative approach, in that it favors variety and alternatives over one detailed, linear five-year business plan to reach steady state operations. From a problem solving and systems thinking perspective, student teams create different possible versions of a new venture and alternative hypotheses about value creation for customers and value capture vis-à-vis competitors. To test critical hypotheses early on, student teams engage in an evidence-based, experimental trial-and-error learning process that measures real progress. Upon completion of this course, students will be able to: · Apply a modern innovation toolkit relevant in both the corporate & startup world · Analyze given business opportunities in terms of its constituent elements · Design new business models by gathering and combining relevant ideas, facts and information · Evaluate business opportunities and derive judgment about next steps & decisions Course language is English, but participants can decide to give their graded presentations in German. Students are invited to apply to this course module already with a startup idea and/ or team, but this is not a requirement! We will form teams and ideas in the beginning of the course. Class meetings have alternate intervals of lecture inputs, teamwork, mentoring, and peer feedback. Attendance is mandatory for at least 80% of class time due to large proportion of teamwork sessions. Student teams give three presentations and submit them with backup analyses. Grading scheme: · Startup discovery presentation after 5 weeks: 30% · Startup validation presentation after 10 weeks: 30% · Final startup pitches after 13 weeks: 40%
Literature	• Blank, S. & Dorf, B. (2012). The startup owner's manual. • Gans, J. & Stern, S. (2016). Entrepreneurial Strategy. • Osterwalder, A. & Yves, P. (2010). Business model generation. • Maurya, A. (2012). Running lean: Iterate from plan A to a plan that works. • Maurya, A. (2016). Scaling lean: Mastering the Key Metrics for Startup Growth. • Wilcox, J. (2016). FOCUS Framework: How to Find Product-Market Fit.

Course L0863: Marketing	
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	
Lecturer	Prof. Christian Lüthje
Language	EN
Cycle	WiSe
Content	**Contents** Basics of Marketing The philosophy and fundamental aims of marketing. Contrasting different marketing fields (e.g. business-to-consumer versus business-to-business marketing). The process of marketing planning, implementation and controlling Strategic Marketing Planning How to find profit opportunities? How to develop cooperation, internationalization, timing, differentiation and cost leadership strategies? Market-oriented Design of products and services

	How can companies get valuable customer input on product design and development? What is a service? How can companies design innovative services supporting the products? Pricing What are the underlying determinants of pricing decision? Which pricing strategies should companies choose over the life cycle of products? What are special forms of pricing on business-to-business markets (e.g. competitive bidding, auctions)? Marketing Communication What is the role of communication and advertising in business-to-business markets? Why advertise? How can companies manage communication over advertisement, exhibitions and public relations? Sales and Distribution How to build customer relationship? What are the major requirements of industrial selling? What is a distribution channel? How to design and manage a channel strategy on business-to-business markets? **Knowledge** Students will gain an introduction and good overview of • Specific challenges in the marketing of innovative goods and services • Key strategic areas in strategic marketing planning (cooperation, internationalization, timing) • Tools for information gathering about future customer needs and requirements • Fundamental pricing theories and pricing methods • Main communication instruments • Marketing channels and main organizational issues in sales management • Basic approaches for managing customer relationship **Skills** Based on the acquired knowledge students will be able to: • Design market timing decisions • Make decisions for marketing-related cooperation and internationalization activities • Manage the challenges of market-oriented development of new products and services • Translate customer needs into concepts, prototypes and marketable offers • Determine the perceived quality of an existing product or service using advanced elicitation and measurement techniques that fit the given situation • Analyze the pricing alternatives for products and services • Make strategic sales decisions for products and services (i.e. selection of sales channels) • Analyze the value of customers and apply customer relationship management tools **Social Competence** The students will be able to • have fruitful discussions and exchange arguments • present results in a clear and concise way • carry out respectful team work **Self-reliance** The students will be able to • Acquire knowledge independently in the specific context and to map this knowledge on other new complex problem fields. • Consider proposed business actions in the field of marketing and reflect on them.
Literature	Homburg, C., Kuester, S., Krohmer, H. (2009). Marketing Management, McGraw-Hill Education, Berkshire, extracts p. 31-32, p. 38-53, 406-414, 427-431 Bingham, F. G., Gomes, R., Knowles, P. A. (2005). Business Marketing, McGraw-Hill Higher Education, 3rd edition, 2004, p. 106-110 Besanke, D., Dranove, D., Shanley, M., Schaefer, S. (2007), Economics of strategy, Wiley, 3rd edition, 2007, p. 149-155 Hutt, M. D., Speh, T.W. (2010), Business Marketing Management, 10th edition, South Western, Lengage Learning, p. 112-116

Course L2440: Mergers & Acquistions (M&A)	
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	Prof. Philipp Haberstock
Language	DE
Cycle	SoSe
Content	
Literature	

Course L0709: Project Management	
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	
Lecturer	Prof. Carlos Jahn
Language	EN
Cycle	WiSe
Content	The lecture “project management” aims at characterizing typical phases of projects. Important contents are: possible tasks, organization, techniques and tools for initiation, definition, planning, management and finalization of projects. This will also be deepened by exercises within the framework of the event. The following topics will be covered in the lecture: • SMART, Work Breakdown Structure, Operationalization, Goals relation matrix • Metra-Potential Method (MPM), Critical-Path Method (CPM), Program evaluation and review technique (PERT) • Milestone Analysis, Earned Value Analyis (EVA) • Progress reporting, Tracing of project goals, deadlines and costs, Project Management Control Loop, Maturity Level Assurance (MLA) • Risk Management, Failure Mode and Effects Analysis (FMEA), Risk Matrix
Literature	Project Management Institute (2017): A Guide to the Project Management Body of Knowledge (PMBOK® Guide) 6. Aufl. Newtown Square, PA, USA: Project Management Institute. DeMarco, Tom (1997). The Deadline: A Novel About Project Management. DIN Deutsches Institut für Normung e.V. (2009). Projektmanagement - Projektmanagementsysteme - Teil 5: Begriffe. (DIN 69901-5) Frigenti, Enzo and Comninos, Dennis (2002). The Practice of Project Management. Haberfellner, Reinhard (2015). Systems Engineering: Grundlagen und Anwendung Harrison, Frederick and Lock, Dennis (2004). Advanced Project Management: A Structured Approach. Heyworth, Frank (2002). A Guide to Project Management. ISO - International Organization for Standardization (2012). Guidance on Project Management. (21500:2012(E)) Kerzner, Harold (2013). Project Management: A Systems Approach to Planning, Scheduling, and Controlling. Lock, Dennis (2018). Project Management. Martinelli, Russ J. and Miloševic, Dragan (2016). Project Management Toolbox: Tools and Techniques for the Practicing Project Manager. Murch, Richard (2011). Project Management: Best Practices for IT Professionals. Patzak, Gerold and Rattay, Günter (2009). Projektmanagement: Leitfaden zum Management von Projekten, Projektportfolios, Programmen und projektorientierten Unternehmen.

Course L1385: Project Management in Industrial Practice	
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	
Lecturer	Dipl.-Ing. Wilhelm Radomsky
Language	DE
Cycle	WiSe
Content	• Project management in a company • Project life cycle / Project environment • Project structuring / Project planning • Deployment of methods / Team development • Contract / Risk / Change management • Multi-project management / Quality management • Project controlling / Reporting • Project organization / Project conclusion
Literature	• Brown (1998): Erfolgreiches Projektmanagement in 7 Tagen • Burghardt (2002): Einführung in Projektmanagement • Cleland / King (1997): Project Management Handbook • Hemmrich, Harrant (2002): Projektmanagement, In 7 Schritten zum Erfolg • Kerzner (2003): Projektmanagement • Litke (2004): Projektmanagement • Madauss (2005): Handbuch Projektmanagement • Patzak / Rattay (2004): Projektmanagement • PMI (2004): A Guide to the Project Management Body of Knowledge • RKW / GPM: Projektmanagement Fachmann • Schelle / Ottmann / Pfeiffer (2005): ProjektManager

Course L1897: Project Management and Agile Methods	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Fachtheoretisch-fachpraktische Arbeit
Examination duration and scale	Ausarbeitung eines Projektplans in Kleingruppen (ca. 5-10 Seiten)
Lecturer	Christian Bussler
Language	DE
Cycle	SoSe
Content	The Seminar teaches the basics of project management, which constitutes the foundations for technical as well as for business projects. It also includes a sideline about process management. The participants will work on the following questions: • What is a project and what challenges does it imply? • What methods have been developed to meet those challenges? • How have this methods evolved over time? What is “state of the art” today? • What basic skills should project members have? • What is the difference between project and process? How can the latter be analyzed? The approaches are not just taught theoretically, but put to use in group work. Through this approach, participants are enabled to work successfully on actual projects - and manage projects later on. As project work is increasingly important in work life, project management is a key skill for job applicants. Main topics of the seminar include: • The “magic triangle” of project objectives • Typical project phases • Key instruments and methods (project structure plan, RACI, Gantt chart) • Project organization and steering • Team communication and collaboration • The agile approach of Scrum • Process levels and cascading • Process improvement With the knowledge and experience from the seminar, participants should be able to acquire a basic certificate in project management with relatively little additional effort. The certification is available through institutions like GPM. Participants already start working on their homework paper in the group work. It comprises 5 to 10 pages and a structure plan for the chosen project, which can be done in Excel for example. Ideally, the members of the work groups write their homework paper together. The expected scale of the paper would increase in this case, yet not proportionally with the number of group members (4 participants would be expected to hand in a paper of 15-20 pages).
Literature	Hans-D. Litke, Ilonka Kunow; Projektmanagement. 3. Auflage 2015 Georg Patzak, Günter Rattay; Projektmanagement: Projekte, Projektpotfolios, Programme und projektorientierte Unternehmen. 6. Auflage 2014 G P M Deutsche Gesellschaft für Projektmanagement; Kompetenzbasiertes Projektmanagement (PM3): Handbuch für die Projektarbeit, Qualifizierung und Zertifizierung auf Basis der IPMA Competence Baseline Version 3.0. 6. Auflage, 2014 Tom DeMarco; Der Termin: Ein Roman über Projektmanagement. 2007 Jeff Sutherland, Ken Schwaber; Der Scrum Guide. Der gültige Leitfaden für Scrum: Die Spielregeln. Ständig aktualisiert, kostenloser Download auf http://www.scrumguides.org/ Jurgen Appello; Management 3.0: Leading Agile Developers, Developing Agile Leaders. 2010

Course L2349: Accounting and Financial Statements	
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	Prof. Matthias Meyer
Language	DE
Cycle	WiSe/SoSe
Content	
Literature	

Course L1293: Risk Management	
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 Minuten
Lecturer	Dr. Meike Schröder
Language	DE
Cycle	WiSe
Content	Risks are inherent in every aspect of business, and the ability of managing risks is one important aspect that differentiates successful business leaders from others. There exist various categories of risk, such as credit, country, market, liquidity, operational, supply chain and reputational. Companies are vulnerable to risks. What makes such risks even more complex and challenging to manage is that the risks are often not within the direct control of the business executive. They can exist outside of the company boundary, and yet the impact to the company can be huge. The awareness and knowledge of how to manage risks in companies, will become increasingly important. Some of the main topics covered in this lecture include: • Targets and legal aspects of risk management • Risks and their impact • Risk types (classification) • Risk management and human resource • Steps of the risk management process and their instruments • Methods of risk assessment • Implementation of risk management • Management of specific risks This lecture is presented in German language only.
Literature	Brühwiler, B., Romeike, F. (2010), Praxisleitfaden Risikomanagement. ISO 31000 und ONR 49000 sicher anwenden, Berlin: Erich Schmidt. Cottin, C., Döhler, S. (2013), Risikoanalyse. Modellierung, Beurteilung und Management von Risiken mit Praxisbeispielen, 2. überarbeitete und erweiterte Aufl., Wiesbaden: Springer. Eller, R., Heinrich, M., Perrot, R., Reif, M. (2010), Kompaktwissen Risikomanagement. Nachschlagen, verstehen und erfolgreich umsetzen, Wiesbaden: Gabler. Fiege, S. (2006), Risikomanagement- und Überwachungssystem nach KonTraG. Prozess, Instrumente, Träger, Wiesbaden: Deutscher Universitäts-Verlag. Frame, D. (2003), Managing Risk in organizations. A guide for managers, San Francisco: Wiley. Götze, U., Henselmann, K., Mikus, B. (2001), Risikomanagement, Heidelberg: Physica-Verlag. Müller, K. (2010), Handbuch Unternehmenssicherheit. Umfassendes Sicherheits-, Kontinuitäts- und Risikomanagement mit System, 2., neu bearbeitete Auflage, Wiesbaden: Springer. Rosenkranz, F., Missler-Behr, M. (2005), Unternehmensrisiken erkennen und managen. Einführung in die quantitative Planung, Berlin u.a.: Springer. Wengert, H., Schittenhelm F. A. (2013), Coporate Risk Mangement, Berlin: Springer.

Course L1389: Key Aspects of Patent Law	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	
Lecturer	Prof. Christian Rohnke
Language	DE
Cycle	SoSe
Content	Mayor Issues in Patent Law: The seminar covers five mayor issues in german patent law, namely patentatbility, prosecution, ownership and employee inventions, infringement and licensing and other commercila uses. The lecturer will give an introduction to each issue which will be followed by in-depth inquiry by the participants through group work, presentation of results and moderated discussion.
Literature	wird noch bekannt gegeben

Course L1491: Startup Engineering	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Fachtheoretisch-fachpraktische Arbeit
Examination duration and scale	Ausarbeitung einer Geschäftsidee auf 20-30 Seiten (Inhaltsfolien zur detailliierten Dokumentation des Herangehensweise). Bearbeitungsdauer über den ganzen Kurs hinweg 13 Wochen, Zwischen- und Abschlusspräsentation jeweils 15 min plus 15 Diskussion.
Lecturer	Prof. Christoph Ihl
Language	EN
Cycle	WiSe
Content	Important note: This course is part of an 6 ECTS module consisting of the three courses "Startup Engineering", "Startup Engineering Project" and "Entrepreneurship Management", which have to be taken together in one semester. Startups are temporary, team-based organizations, which can form both within and outside of established companies, to pursue one central objective: taking a new venture idea to market by designing a business model that can be scaled to a full-grown company. In this course, students will form startup teams around self-selected ideas and run through the process just like real startups would do in the first three months of intensive work. Startup Engineering takes an incremental and iterative approach, in that it favors variety and alternatives over one detailed, linear five-year business plan to reach steady state operations. From a problem solving and systems thinking perspective, student teams create different possible versions of a new venture and alternative hypotheses about value creation for customers and value capture vis-à-vis competitors. To test critical hypotheses early on, student teams engage in an evidence-based, experimental trial-and-error learning process that measures real progress. Upon completion of this course, students will be able to: · Apply a modern innovation toolkit relevant in both the corporate & startup world · Analyze given business opportunities in terms of its constituent elements · Design new business models by gathering and combining relevant ideas, facts and information · Evaluate business opportunities and derive judgment about next steps & decisions Course language is English, but participants can decide to give their graded presentations in German. Students are invited to apply to this course module already with a startup idea and/ or team, but this is not a requirement! We will form teams and ideas in the beginning of the course. Class meetings have alternate intervals of lecture inputs, teamwork, mentoring, and peer feedback. Attendance is mandatory for at least 80% of class time due to large proportion of teamwork sessions. Student teams give three presentations and submit them with backup analyses. Grading scheme: · Startup discovery presentation after 5 weeks: 30% · Startup validation presentation after 10 weeks: 30% · Final startup pitches after 13 weeks: 40%
Literature	• Blank, S. & Dorf, B. (2012). The startup owner's manual. • Gans, J. & Stern, S. (2016). Entrepreneurial Strategy. • Osterwalder, A. & Yves, P. (2010). Business model generation. • Maurya, A. (2012). Running lean: Iterate from plan A to a plan that works. • Maurya, A. (2016). Scaling lean: Mastering the Key Metrics for Startup Growth. • Wilcox, J. (2016). FOCUS Framework: How to Find Product-Market Fit.

Course L1492: Startup Engineering Project	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	20 min
Lecturer	Prof. Christoph Ihl
Language	EN
Cycle	WiSe
Content	Important note: This course is part of an 6 ECTS module consisting of the three courses "Startup Engineering", "Startup Engineering Project" and "Entrepreneurship Management", which have to be taken together in one semester. Startups are temporary, team-based organizations, which can form both within and outside of established companies, to pursue one central objective: taking a new venture idea to market by designing a business model that can be scaled to a full-grown company. In this course, students will form startup teams around self-selected ideas and run through the process just like real startups would do in the first three months of intensive work. Startup Engineering takes an incremental and iterative approach, in that it favors variety and alternatives over one detailed, linear five-year business plan to reach steady state operations. From a problem solving and systems thinking perspective, student teams create different possible versions of a new venture and alternative hypotheses about value creation for customers and value capture vis-à-vis competitors. To test critical hypotheses early on, student teams engage in an evidence-based, experimental trial-and-error learning process that measures real progress. Upon completion of this course, students will be able to: · Apply a modern innovation toolkit relevant in both the corporate & startup world · Analyze given business opportunities in terms of its constituent elements · Design new business models by gathering and combining relevant ideas, facts and information · Evaluate business opportunities and derive judgment about next steps & decisions Course language is English, but participants can decide to give their graded presentations in German. Students are invited to apply to this course module already with a startup idea and/ or team, but this is not a requirement! We will form teams and ideas in the beginning of the course. Class meetings have alternate intervals of lecture inputs, teamwork, mentoring, and peer feedback. Attendance is mandatory for at least 80% of class time due to large proportion of teamwork sessions. Student teams give three presentations and submit them with backup analyses. Grading scheme: · Startup discovery presentation after 5 weeks: 30% · Startup validation presentation after 10 weeks: 30% · Final startup pitches after 13 weeks: 40%
Literature	• Blank, S. & Dorf, B. (2012). The startup owner's manual. • Gans, J. & Stern, S. (2016). Entrepreneurial Strategy. • Osterwalder, A. & Yves, P. (2010). Business model generation. • Maurya, A. (2012). Running lean: Iterate from plan A to a plan that works. • Maurya, A. (2016). Scaling lean: Mastering the Key Metrics for Startup Growth. • Wilcox, J. (2016). FOCUS Framework: How to Find Product-Market Fit.

Course L2409: Strategic Shared-Value Management	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	30 Minuten
Lecturer	Dr. Jill Küberling-Jost
Language	EN
Cycle	SoSe
Content	
Literature	

Course L2295: Strategische Planung mit Planspielen	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	
Lecturer	Dr. Jan Spitzner
Language	DE
Cycle	SoSe
Content	
Literature	

Course L2410: Technology Entrepreneurship	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	30 Minuten
Lecturer	Prof. Christoph Ihl
Language	EN
Cycle	SoSe
Content	
Literature	

Course L1351: Management Consulting	
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	
Lecturer	Gerald Schwetje
Language	DE
Cycle	SoSe
Content	The Management Consulting lecture teaches students knowledge that is complementary to their technical and business administration studies. They learn the basics of consulting and agent-principal theory and are given an overview of the consulting market. They are also shown how management consulting works and which methodical building blocks (processes) are needed to deal with a client’s concerns and to undertake a consulting process. By means of practical examples students gain an insight into the extensive range of management consultancy services and of functional consulting.
Literature	Bamberger, Ingolf (Hrsg.): Strategische Unternehmensberatung: Konzeptionen - Prozesse - Methoden, Gabler Verlag, Wiesbaden 2008 Bansbach, Schübel, Brötzel & Partner (Hrsg.): Consulting: Analyse - Konzepte - Gestaltung, Stollfuß Verlag, Bonn 2008 Fink, Dietmar (Hrsg.): Strategische Unternehmensberatung, Vahlens Handbücher, München, Verlag Vahlen, 2009 Heuermann, R./Herrmann, F.: Unternehmensberatung: Anatomie und Perspektiven einer Dienstleistungselite, Fakten und Meinungen für Kunden, Berater und Beobachter der Branche, Verlag Vahlen, München 2003 Kubr, Milan: Management consulting: A guide to the profession, 3. Auflage, Geneva, International Labour Office, 1992 Küting, Karlheinz (Hrsg.): Saarbrücker Handbuch der Betriebswirtschaftlichen Beratung; 4. Aufl., NWB Verlag, Herne 2008 Nagel, Kurt: 200 Strategien, Prinzipien und Systeme für den persönlichen und unternehmerischen Erfolg, 4. Aufl., Landsberg/Lech, mi-Verlag, 1991 Niedereichholz, Christel: Unternehmensberatung: Beratungsmarketing und Auftragsakquisition, Band 1, 2. Aufl., Oldenburg Verlag, 1996 Niedereichholz; Christel: Unternehmensberatung: Auftragsdurchführung und Qualitätssicherung, Band 2, Oldenburg Verlag, 1997 Quiring, Andreas: Rechtshandbuch für Unternehmensberater: Eine praxisorientierte Darstellung der typischen Risiken und der zweckmäßigen Strategien zum Risikomanagement mit Checklisten und Musterverträgen, Vahlen Verlag, München 2005 Schwetje, Gerald: Ihr Weg zur effizienten Unternehmensberatung: Beratungserfolg durch eine qualifizierte Beratungsmethode, NWB Verlag, Herne 2013 Schwetje, Gerald: Wer seine Nachfolge nicht regelt, vermindert seinen Unternehmenswert, in: NWB, Betriebswirtschaftliche Beratung, 03/2011 und: Sparkassen Firmenberatung aktuell, 05/2011 Schwetje, Gerald: Strategie-Assessment mit Hilfe von Arbeitshilfen der NWB-Datenbank - Pragmatischer Beratungsansatz speziell für KMU: NWB, Betriebswirtschaftliche Beratung, 10/2011 Schwetje, Gerald: Strategie-Werkzeugkasten für kleine Unternehmen, Fachbeiträge, Excel-Berechnungsprogramme, Checklisten/Muster und Mandanten-Merkblatt: NWB, Downloadprodukte, 11/2011 Schwetje, Gerald: Die Unternehmensberatung als komplementäres Leistungsangebot der Steuerberatung - Zusätzliches Honorar bei bestehenden Klienten: NWB, Betriebswirtschaftliche Beratung, 02/2012 Schwetje, Gerald: Die Mandanten-Berater-Beziehung: Erfolgsfaktor Beziehungsmanagement, in: NWB Betriebswirtschaftliche Beratung, 08/2012 Schwetje, Gerald: Die Mandanten-Berater-Beziehung: Erfolgsfaktor Vertrauen, in: NWB Betriebswirtschaftliche Beratung, 09/2012 Wohlgemuth, Andre C.: Unternehmensberatung (Management Consulting): Dokumentation zur Vorlesung „Unternehmensberatung“, vdf Hochschulverlag, Zürich 2010

Course L0536: Management of Trust and Reputation	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	20-30 Minuten und Thesenpapier
Lecturer	Dr. Michael Florian
Language	DE
Cycle	SoSe
Content	The seminar offers a comparison and analysis of relevant theoretical concepts and practical issues in the corporate management of trust and reputation. Selected case studies will be used to discuss opportunities, problems, and limitations using trust and reputation to coordinate and control economic behavior.
Literature	Allgäuer, Jörg E. (2009): Vertrauensmanagement: Kontrolle ist gut, Vertrauen ist besser. Ein Plädoyer für Vertrauensmanagement als zentrale Aufgabe integrierter Unternehmenskommunikation von Dienstleistungsunternehmen. München: brain script Behr. Beckert, Jens; Metzner, André; Roehl, Heiko (1998): Vertrauenserosion als organisatorische Gefahr und wie ihr zu begegnen ist. In: Organisationsentwicklung 17 (4), S. 57-66. Eberl, Peter (2003): Vertrauen und Management. Studien zu einer theoretischen Fundierung des Vertrauenskonstruktes in der Managementlehre. Stuttgart: Schäffer-Poeschel. Eberl, Peter (2012): Vertrauen und Kontrolle in Organisationen. Das problematische Verhältnis der Betriebswirtschaftslehre zum Vertrauen. In: Möller, Heidi (Hg.): Vertrauen in Organisationen. Riskante Vorleistung oder hoffnungsvolle Erwartung? Wiesbaden: Springer VS, S. 93-110. Eisenegger, Mark (2005): Reputation in der Mediengesellschaft. Konstitution Issues Monitoring Issues Management. Wiesbaden: VS Verlag für Sozialwissenschaften. Florian, Michael (2013): Paradoxien des Vertrauensmanagements. Risiken und Chancen einer widerspenstigen immateriellen Ressource. In: Personalführung 46, Heft 2/2013, S. 40-47. Grüninger, Stephan (2001): Vertrauensmanagement - Kooperation, Moral und Governance. Marburg: Metropolis. Grüninger, Stephan; John, Dieter (2004): Corporate Governance und Vertrauensmanagement. In: Josef Wieland (Hg.): Handbuch Wertemanagement. Erfolgsstrategien einer modernen Corporate Governance. Hamburg: Murmann, S. 149-177. Meifert, Matthias (2008): Ist Vertrauenskultur machbar? Vorbedingungen und Überforderungen betrieblicher Personalpolitik. In: Rainer Benthin und Ulrich Brinkmann (Hg.): Unternehmenskultur und Mitbestimmung. Betriebliche Integration zwischen Konsens und Konflikt. Frankfurt/Main, New York: Campus, S. 309-327. Neujahr, Elke; Merten, Klaus (2012): Reputationsmanagement. Zur Kommunikation von Wertschätzung. In: PR-Magazin 06/2012, S. 60-67. Osterloh, Margit; Weibel, Antoinette (2006): Investition Vertrauen. Prozesse der Vertrauensentwicklung in Organisationen. Wiesbaden: Gabler. Osterloh, Margit; Weibel, Antoinette (2006): Vertrauen und Kontrolle. In: Robert J. Zaugg und Norbert Thom (Hg.): Handbuch Kompetenzmanagement. Durch Kompetenz nachhaltig Werte schaffen. Festschrift für Prof. Dr. Dr. h.c. mult. Norbert Thom zum 60. Geburtstag. Bern [u.a.]: Haupt, S. 53-63. Osterloh, Margit; Weibel, Antoinette (2007): Vertrauensmanagement in Unternehmen: Grundlagen und Fallbeispiele. In: Manfred Piwinger und Ansgar Zerfaß (Hg.): Handbuch Unternehmenskommunikation. Wiesbaden: Gabler, S. 189-203. Schmidt, Matthias; Beschorner, Thomas (2005): Werte- und Reputationsmanagement. München und Mering: Hampp. Seifert, Matthias (2003): Vertrauensmanagement in Unternehmen. Eine empirische Studie über Vertrauen zwischen Angestellten und ihren Führungskräften. 2. Aufl. München und Mering: Hampp. Sprenger, Reinhard K. (2002): Vertrauen führt. Worauf es im Unternehmen wirklich ankommt, Frankfurt/Main, New York. Thiessen, Ansgar (2011): Organisationskommunikation in Krisen. Reputationsmanagement durch strategische, integrierte und situative Krisenkommunikation. Wiesbaden: VS Verlag für Sozialwissenschaften. Walgenbach, Peter (2000): Das Konzept der Vertrauensorganisation. Eine theoriegeleitete Betrachtung. In: Die Betriebswirtschaft 60 (6), S. 707-720. Walgenbach, Peter (2006): Wieso ist Vertrauen in ökonomischen Transaktionsbeziehungen so wichtig, und wie lässt es sich generieren? In: Hans H. Bauer, Marcus M. Neumann und Anja Schüle (Hg.): Konsumentenvertrauen. Konzepte und Anwendungen für ein nachhaltiges Kundenbindungsmanagement. München: Vahlen, S. 17-26. Weibel, Antoinette (2004): Kooperation in strategischen Wissensnetzwerken. Vertrauen und Kontrolle zur Lösung des sozialen Dilemmas. Wiesbaden: Dt. Univ.-Verl. Weinreich. Uwe (2003): Vertrauensmanagement. In: Deutscher Manager-Verband e.V. (Hg.): Die Zukunft des Managements. Perspektiven für die Unternehmensführung. Zürich: Vdf, Hochsch.-Verl. an der ETH, S. 193-201.

Course L1381: Public and Constitutional Law	
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	2 Stunden
Lecturer	Klaus-Ulrich Tempke
Language	DE
Cycle	WiSe/SoSe
Content	Different areas of public law; proceedings, jurisdiction of administrative courts with stages of appeal, members of the courts; Court levels, organization and legal capacity; Introduction to and structure of fundamental rights; Human dignity: the guiding principle of the constitution; General right of privacy and freedom of action.
Literature	

Module M0524: Non-technical Courses for Master

Module Responsible	Dagmar Richter
Admission Requirements	None
Recommended Previous Knowledge	None
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	**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** 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.
Skills	**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, • 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	
Social 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.
Autonomy	**Personal Competences (Self-reliance)** Students are able in selected areas • to reflect on their own profession and professionalism in the context of real-life fields of application • to organize themselves and their own learning processes • 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

Course L1775: “What’s up, Doc?” Science and Stereotypes in Literature and Film	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Jennifer Henke
Language	EN
Cycle	WiSe/SoSe
Content	Popular novels and films significantly contribute to the public understanding of science and its representatives. How to define “good” or “bad” science is negotiated in a variety of artistic works. Stereotypes such as the “mad scientist”, which originated in early nineteenth century England, continue to persist. Mary Shelley created the prototype of the obsessive and reckless scientist in Frankenstein - The Modern Prometheus (1818) who conducts his forbidden experiments in a secret lab and crosses ethical boundaries. This masculine stereotype has been followed by further ones such as the noble, adventurous or clumsy scientist, whereas scholars have only recently begun to consider the representation of female science. First, this seminar is devoted to selected formations of knowledge in relation to literature from classical antiquity to the present. Second, the focus shall rest on the production of persistent stereotypes in various media formats such as novels or films while paying particular attention to the aspect of gender. The overall goal of the seminar is an understanding of science as a cultural practice. Requirements for participation: Shelley, Mary: Frankenstein. New York: Norton, 2012. Please pay attention to the exact publication dates.
Literature	Teilnahmevoraussetzungen: Shelley, Mary: Frankenstein. New York: Norton, 2012. Bitte ausschließlich diese Edition anschaffen.

Course L2064: 120 years of film history	
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	90 min
Lecturer	Prof. Margarete Jarchow
Language	DE
Cycle	SoSe
Content	The lecture deals with the relationship between the develpoment of film technology, film aesthetics, and society. Based on the nineteenth-century film's precursors such as the laterna magica, photography and kinetoscope, crucial stages of more than 120 years of film history are studied chronologically in terms of: How does the development of new media techniques reflect certain social changes and needs? What new forms of aesthetic expression are possible through such technical innovations as the introduction of sound film, color film or handheld camera? And to what extent do these new forms of aesthetic expression in turn reflect certain social sensitivities, ultimately the respective zeitgeist? Main topics of the lecture are: the technical euphoria of the 19th century, the early film, the German Expressionist film, the classic Hollywood cinema, the European postwar cinema, exploitation and underground cinema, New Hollywood, the blockbuster cinema, independent cinema up to current phenomena like the „cinema of dissolution“. On the one hand, the participants learn in-depth, detailed knowledge of the history, meaning and analysis of the medium film and thereby acquire media literacy. On the other hand, the participants should gain a deeper understanding of the real interdependencies of technologies in culture and society and their historical transformation processes through an interdisciplinary perspective on film (history of technology, media studies and social science).
Literature	

Course L1774: Applied Arts: Form and Function	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Prof. Margarete Jarchow, Dr. Christian Lechelt
Language	DE
Cycle	WiSe/SoSe
Content	From Arts & Crafts to modern Design - applied arts focus on the design of all kinds of products. Therefore applied arts allow to come to more thorough conclusions about social, historical, cultural issues. In the course the impact of social developments on these particular genres are discussed.
Literature	Wird noch angegeben Will be announced in lecture

Course L2338: Bauhaus architecture - a search for traces	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Jörg Schilling
Language	DE
Cycle	WiSe/SoSe
Content	The „100 years of bauhaus“ centenery also involved examining the references, differences and similarities to Hamburg architecture from 1919-1933. The seminar intends to find these traces in social (i.e. Jarrestadt) and private (i.e. Landhaus Michaelsen / Puppenmuseum) housing as well as in numerous other building projects. During the excursions to buildings by Hamburg architects like Fritz Schumacher, Gustav Oelsner, Karl Schneider and others we will discuss aspects related to architectural modernism.
Literature	wird im Seminar bekanntgegeben

Course L1882: Facilitating groups in problem-oriented courses	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Fachtheoretisch-fachpraktische Arbeit
Examination duration and scale	Schriftliche Ausarbeitung (in mehreren Teilen) sowie eine Präsentation, Teilnahme an Gruppendiskussionen
Lecturer	Siska Simon
Language	DE
Cycle	WiSe/SoSe
Content	Content: - Changing the role of the teacher in problem-oriented courses - Structure and benefits of problem-oriented courses - Attitude and beliefs concerning teaching and learning - Question and discussion techniques - Group dynamic processes - Situation-related interventions - dealing with heterogeneous groups - Moderation and presentation - Interference levels and conflict management - Feedback processes and methods Methods: - impulse lectures and group work - Planning, execution and reflection of an exemplary course unit - Micro teaching and feedback - peer observation and feedback
Literature	Auszüge aus Fachliteratur zu oben genannten Themen werden in der Veranstaltung ausgegeben

Course L1990: Clash of Cultures. Film and TV series as images of the own and the other	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Jacobus Bracker
Language	DE
Cycle	WiSe/SoSe
Content	Images are negotiating concepts of the own, other and alien. Especially tv series like “Game of Thrones”, “Vikings”, or “The Walking Dead” and films like “Alien” or “Lord of the Rings” show clashes of cultures. Irrespective of their genre - fantasy, science fiction, or history - the moving images use always similar patterns to show and tell the own and the other. During the seminar we will deal with such concepts and concepts of culture and the specifics of film and series to watch and analyse selected examples from these perspectives.
Literature	Literaturhinweise, Texte etc. werden zu gegebener Zeit online zur Verfügung gestellt.

Course L1176: The end is near - Survival in the post-apocalypse	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Marlis Bussacker
Language	DE
Cycle	WiSe/SoSe
Content	According to the FAZ in December 2015, the end of the world is booming. At all times, people have dealt with the imminent future scenario of ultimate horror - the collapse of their own world. Where does the idea of a final disaster come from? What's so fascinating about our own demise? During the seminar we will take a look at European cultural history, which is closely linked to mythological and religious prophecies about the end of the world. However, this question, or rather the question of survival in a post-apocalyptic world, has fortunately remained speculative to this day despite regular predictions. Since the end of the world has not yet happened in reality, we are therefore dependent on the imagination of writers, screenwriters and directors who have anticipated the event in an infinite number of texts, films and series. Based on selected films and texts, the seminar will focus on the questions of which apocalyptic scenarios are developed, with which problems the survivors are confronted and how they deal with the situation and with each other. The focus is on the reactions of people in a state of extreme threat. Which survival strategies are presented to us, how do we assess the behaviour of the actors, can we create alternatives? Furthermore, the effect of the genre on the recipient will be discussed. Do we dismiss films like Armaggedon and The Day After Tomorrow as entertaining thrills? Do we just enjoy the special effects? Do we feel threatened? Do we take them in the end as real instructions for action? Do they make us reflect? Or are even current social discourses reflected in the garment of the apocalypse?
Literature	

Course L1441: German as a Foreign Language for International Master Programs	
Typ	Seminar
Hrs/wk	4
CP	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Examination Form	Klausur
Examination duration and scale	
Lecturer	Dagmar Richter
Language	DE
Cycle	WiSe/SoSe
Content	Master’s German course in cooperation with IBH e.V. - Master’s German courses at different levels In the international studies program these are obligatory for non-native speakers of German and for students without a DSH certificate or equivalent TEST-DAF result. Grading after an aptitude test. All other students must sign up for a total of 4 ECTS from the catalog of non-technical supplementary courses.
Literature	- Will be announced in lectures -

Course L1884: The Hamburger Speicherstadt - from achievements of engineering to world cultural heritage	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	20 minütiges Referat mit anschließender Diskussion
Lecturer	Dr. Jörg Schilling
Language	DE
Cycle	WiSe/SoSe
Content	The seminar wants to show the problems and challenges for the engineers, who built the Hamburger Speicherstadt and their sustainable architectural solutions, which are still of vital importance and the basis for becoming a world cultural heritage.
Literature	u.a.: Hamburg und seine Bauten unter Berücksichtigung seiner Nachbarstädte Altona und Wandsbek, hg. vom Architekten- und Ingenieur-Verein zu Hamburg, Hamburg 1890; Karin Maak: Die Speicherstadt im Hamburger Hafen, Hamburg 1895; Hermann Hipp: Freie und Hansestadt Hamburg, Köln 1989; Matthias von Popowski: Franz Andreas Meyer (1837-1901). Oberingenieur und Leiter des Ingenieurwesens von 1872-1901, in: Wie das Kunstwerk Hamburg entstand, hg. v. Dieter Schädel, Hamburg 2006, S. 64-79; Ralf Lange: HafenCity + Speicherstadt : das maritime Quartier in Hamburg, Hamburg 2010.

Course L1996: Digital culture(s): from subculture to media mainstream	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Oliver Schmidt
Language	DE
Cycle	WiSe/SoSe
Content	The course gives an introduction to the development of digitization in a media cultural perspective. In addition to technical aspects, we will focus on the cultural impact of digitization for current media users and the ermergence und development of media subcultures from the late 1970s to the 21st century. On the one hand, we will deal with questions such as: What is digitization? What is culture? What are digital (sub)cultures? In this context, the concept of ‚digital natives‘ and ‚digital immigrants‘, coined by Marc Prensky, will also be discussed. On the other hand, there will be a historical perspective on topics and developments such as the mediatization oft he children’s room in the early 1980s, the hacker scene, video game culture, the demo scene, digital culture in cinema, 8-bit culture, digital aesthetics , net art, post-digitality and ultimately the question of how digital subcultures have become part of the media mainstream at the beginning of the 21st century.
Literature	

Course L2367: Digital art	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	Referat ca. 20 min. plus anschließende Diskussion
Lecturer	Dr. Imke Hofmeister
Language	DE
Cycle	WiSe/SoSe
Content	Digitalization is having a major impact on many areas of our lives and the use of digital technologies in art and design has increased rapidly. After all, art is not only subject to constant change, but also constantly adapts to technical conditions. After the photographic art of the mid-19th century and the video art of the 1960s, which already brought about major changes in artistic creation, digital art is becoming increasingly important in the field of media art. The first attempts to use the computer with corresponding graphic software as an artistic medium took place in the 80/90s of the 20th century. Since then, there has been a broad development in the field of digital art, which now encompasses the most diverse digital pictorial phenomena and art genres and is thus intertwined in its objects, theories and practices with digital media in a variety of ways. The seminar gives an overview of the history of digital art and its different genres. These include, for example, photopaintings, where digital manipulation, filtering processes and painting can process the image and transform it over many stages into a completely new form. Also 3-D images, vector graphics, mathematical art and computer art in general. At the same time, the digital development in art is to be illuminated, from the first beginnings on the computer with comparatively simple "digital aids", e.g. in the form of simple image processing programs, to the present sophisticated graphic tools. In addition, the presentation, dissemination and conservation possibilities of digital art will also be discussed, which can be disseminated very well on the Internet primarily because it can be displayed on a computer screen. The great fascination with digital creative work and the almost inexhaustible possibilities offered by the medium of computers to artists, who will continue to ensure that digital art finds a permanent place alongside traditional media, will also be discussed. Finally, in contrast to the traditional production methods in the field of fine arts and design, there are always new manifestations of digital art, which ultimately give not only the "trained" artist but also the layman far-reaching possibilities for artistic expression. And all this in the spirit of the performance artist Joseph Beuys , who postulated, every human being is capable of creativity, indeed "every human being is an artist". The seminar will also discuss the question of how digital art can be described as "the" contemporary art, i.e. contemporary art in the age of digital technology. Furthermore, it is of great interest to what extent the perception of art per se has already changed and will continue to change in a digitalized society.
Literature	folgt

Course L1725: Introduction to the Science & Technoloy Studies (STS)	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	Gruppenreferat (30 bis 45 Minuten, Eigenanteil je Person 10 bis 15 Minuten) inkl. schriftlicher Ausarbeitung, Ggf. alternativ eine längere, schriftliche Ausarbeitung.
Lecturer	Dr. Simon Egbert
Language	EN
Cycle	WiSe/SoSe
Content	Since the end of the 1980's or the beginning of the 1990's, in the Sociology of Technology a line of research has emerged which initially called for a socialization of the sociology of technology (especially through the Social Construction of Technology Approach [SCOT]) and right away called for its re-materialisation (especially through Bruno Latour and the Actor-Network Theory). Technologies, thus their basic idea, are always intertwined with society and shaped by their socio-cultural context. In reverse, society is also inherently formed by the existing technologies and an adequate sociology of technology has to deal especially with the interaction of both. In the seminar at hand first of all an overview shall be given about the classical sociology of technology which routinely used argumentations inspired by technological determinism, which shall be followed by the presentation of the SCOT-approach. The later in turn was criticised by the Actor-Network Theory (which will be presented in a separate section as well) as being social deterministic which has led to a rather heated debate about the agency of technological artefacts, which shall be presented and discussed in a further part of the seminar. In the last section of the class it shall be determined what kind of relevance the sociological analysis of technological artefacts and their societal embedding can or could implicate for the own lifeworld of the students - especially of course with special focus on their engineer studies.
Literature	Bammé, Arno (2009): Science and Technology Studies: ein Überblick. Marburg: Metropolis. Degele, Nina (2002): Einführung in die Techniksoziologie. München: Fink. Hackett, Edward et al. (Hrsg.) (2008): The Handbook of Science and Technology Studies. 3 rd Edition. Cambridge: MIT Press. Häußling, Roger (2014): Techniksoziologie. Baden-Baden: Nomos. MacKenzie, Donald/Judy, Wajcman (2003): The social shaping of technology. 2 nd Edition. Maidenhead et al.: Open University Press. Sismondo, Sergio (2010): An Introduction to Science and Technology Studies, 2 nd Edition. Chichester: Wiley-Blackwell.

Course L2336: Introduction to Marxian Theory of Economy	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Klausur
Examination duration and scale	90 min
Lecturer	Dr. Martin Schütz
Language	DE
Cycle	WiSe/SoSe
Content	Capitalism - what’s the definition in Marxian economical theorie? Which are the functions of gold, money, interest? Focusing on the Marxian basis categories Ware - Gebrauchswert - Tauschwert - Wert - Arbeit - Austauschprozess - Geld - Zirkulation - Arbeitskraft, the subjects of the lecture are the first four chapters of ‘Das Kapital’ vol. 1, accompanied by discussion of neo-classical theory, monetarism etc.
Literature	Karl Marx, Das Kapital, Band 1, Berlin 1962ff (=Marx-Engels-Werke [MEW] Bd. 23), S. 1-390 Dieser Text steht text- und seitengenau im Internet zur Verfügung: http://www.mlwerke.de/me/me23/me23_000.htm oder http://www.zeno.org/Philosophie/M/Marx,+Karl/Das+Kapital David Harvey, Marx‘ Kapital lesen, Hamburg 2017, Seiten 1-214 Begleitend: Harvey selbst hat seine ‚Kapital‘-Seminare (auf Englisch) als Stream veröffentlicht: http://davidharvey.org/reading-capital/ Ergänzende Literatur: Altvater, Elmar (Hg.) (1999): Kapital.doc. Das Kapital (Bd. 1) von Marx in Schaubildern mit Kommentaren. Mit CD-ROM. Münster Artus, Ingrid u.a. (Hg.) (2014): Marx für SozialwissenschaftlerInnen. Eine Einführung. Wiesbaden Fülberth, Georg (2008): G Strich. Kleine Geschichte des Kapitalismus. 4., verb. und erw. Aufl. Köln Krause, Alexandra (2014): Kritik der Politischen Ökonomie - Wachstum als Imperativ kapitalistischen Wirtschaftens. In: Artus (2014) S. 135-160. Münch, Richard (2008): Soziologische Theorie. Grundlegung durch die Klassiker. Korr. Nachdr. 2008. Frankfurt/Main (Soziologische Theorie, 1). Nachtwey, Oliver (2014): Arbeit, Lohnarbeit und Industriearbeit. In: Artus (2014) S. 109-134 Söllner, Fritz (2015): Die Geschichte des ökonomischen Denkens. 4. Aufl. Berlin

Course L1994: Facts, Facts, Facts - Understanding and Applying Techniques of Journalism - in German	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Prof. Margarete Jarchow, Matthias Kowalski
Language	DE
Cycle	WiSe/SoSe
Content	Regardless of whether it is via classic channels such as newspapers and magazines or radio and TV as well as via internet, social media or via communication in specialist circles: Today we encounter journalism in almost all forms of public and private communication. But what makes a story really important in this flood of content? How do we recognize relevance? How do we expose fake news? In this block seminar the principles of journalistic techniques are imparted by means of practical examples and editorial exercises. The participants also develop tools to detect and deactivate manipulation and fake news. Regular attendance and attendance at all block dates is required.
Literature	

Course L2370: Facts, Facts, Facts - Understanding and Applying Techniques of Journalism - in English	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Prof. Margarete Jarchow
Language	EN
Cycle	WiSe/SoSe
Content	Regardless of whether it is via classic channels such as newspapers and magazines or radio and TV as well as via internet, social media or via communication in specialist circles: Today we encounter journalism in almost all forms of public and private communication. But what makes a story really important in this flood of content? How do we recognize relevance? How do we expose fake news? In this block seminar the principles of journalistic techniques are imparted by means of practical examples and editorial exercises. The participants also develop tools to detect and deactivate manipulation and fake news. Regular attendance and attendance at all block dates is required.
Literature	folgt

Course L0970: Foreign Language Course	
Typ	Seminar
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	Dagmar Richter
Language	
Cycle	WiSe/SoSe
Content	In the Field of the Nontechnical Complementary Courses students are able to chose foreign language courses. Therefore the Hamburger Volkshochschule offers a special language programm on TUHH campus for TUHH Students. It includes courses in english, chinese, french, japanese, portuguese, russia, swedish, spanisch and german as a foreign language. All lectures impart common language knowledge, english courses although english for technical purposes.
Literature	Kursspezifische Literatur / selected bibliography depending on special lecture programm.

Course L0983: Management and Communication	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	90-minütige interaktive Präsentation im Team inkl. Handout.
Lecturer	Wibke Derboven
Language	DE
Cycle	SoSe
Content	The seminar will present basic elements of personality-promoting work organisation, motivation theories, different management concepts, communication theories and approaches to conflict and knowledge management. These subjects are applied to specific practical examples. Participants are given the opportunity to reflect on their own communicative and social behaviour.
Literature	Große Boes, Stefanie; Kaseric, Tanja (2010): Trainer-Kit. Die wichtigsten Trainings-Theorien, ihre Anwendung im Seminar und Übungen für den Praxistransfer. 4. Aufl. Bonn: managerSeminare Verlags GmbH Klutmann, Beate (2004): Führung: Theorie und Praxis. Hamburg: Windmühle Laufer, Hartmut (2011): Grundlagen erfolgreicher Mitarbeiterführung. Führungspersönlichkeit, Führungsmethoden, Führungsinstrumente. 11. Auflage. Offenbach: GABAL Neuberger, Oswald (2002): Führen und führen lassen. 6. überarb. und erw. Aufl. Stuttgart: Lucius und Lucius Schulz von Thun, Friedemann; Ruppel, Johannes; Stratmann, Roswitha (2002): Miteinander reden: Kommunikationspsychologie für Führungskräfte. 4. Aufl. Reinbek bei Hamburg

Course L1883: Guest, barbarian or subject with equal rights? ‘The refugee’ in the history of ‘Western’ political ideas.	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	5-10 Minuten Vortrag im Rahmen eines Gruppenreferats; anschließend Diskussion
Lecturer	Dr. Simone Beate Borgstede
Language	DE/EN
Cycle	WiSe/SoSe
Content	The seminar discusses concepts of ‘the refugee’ in the history of ‘Western’ political ideas over a period of about 2,750 years. We will try to understand these concepts as historically distinct. We will also analyze the powerful effect of related stereotypes and images. We will read and contextualize philosophical, sociological, juridical, literary and political texts. In the second part of the seminar we will use the patterns we found to understand actual discourses on flight and migration. One aim is also to recognize alternative representations in the articulations and practices of the refugees themselves.
Literature	Agamben, Giorgio, ‚Homo Sacer: Die souveräne Macht und das nackte Leben.’ Arendt, Hannah, ‚Wir Flüchtlinge’ und ‚Das Recht, Rechte zu haben’. Aristoteles, Politik und Platon, Politeia (Auszüge). Derrida, Jacques, ‚Weltbürger aller Länder, noch eine Anstrengung!’ Erpenbeck, Jenny: Gehen, ging, gegangen. Roman. Genfer Konvention und Menschenrechtserklärung. Homer, Die Odyssee. Simmel, Georg, ‚Exkurs über den Fremden’. Dazu kommen Textstellen aus Bibel und Koran, aktuelle Interviews mit Migrationsforscher_innen wie Manuela Bojadzijev und Vassilis Tsianos, aber auch Erklärungen von Geflüchteten-Gruppen, Musiktexte, Fotographien und Filmspots.

Course L1844: Stay cool in conflict. Nonviolent Communication by Marshall Rosenberg	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	2-3 Seiten bzw. 10-20 Minuten plus anschließende Besprechung
Lecturer	Dr. Claudia Wunram
Language	EN
Cycle	WiSe/SoSe
Content	„Words can build bridges or create rafts“ - this is also true for the scientific and business world. For example, how do I react if I get attacked in a professional debate by an opponent or by a colleague in my team, or if a fight arises during the planning of a project? In a challenging situation, what will help me to communicate respectfully and with appreciation? How can I express criticism or irritation honestly, directly and without reproach? Nonviolent Communication is a concept developped by Marshall B. Rosenberg, Ph.D., intended to help create an appreciative attitude towards oneself and others, and to live by it. Nonviolent Communication opens paths to express oneself in a mindful and responsible way, so that a bridge can be built even in challenging situations of conflict. Effective and satisfactory cooperation is only possible with well functioning communication between all parties involved, otherwise things will become difficult and inefficient. By working with their own examples and anticipating questions that might arise in their future professional lives, the students of Engineering Sciences will be able to reflect their own communicative behavior and learn ways of cooperation and conjoint solution finding. This course will impart the essential competencies of communication necesary for that.
Literature	German: • Rosenberg, Marshall. (2001) Gewaltfreie Kommunikation. Eine Sprache des Lebens. Junfermann • Rosenberg, Marshall B. und Seils, Gabriele. (15. Auflage 2012) Konflikte lösen durch Gewaltfreie Kommunikation. Ein Gespräch mit Gabriele Seils. Herder Taschenbuch • Larsson, Liv. (2013) 42 Schlüsselunterscheidungen in der GFK. Für ein tieferes Verständnis der Gewaltfreien Kommunikation. Junfermann • De Haen, Nayoma V. und Torsten Hardieß. (2015) 30 Minuten Gewaltfreie Kommunikation. Gabal • Connor, Jane M. und Killian, Dian, Drs. (2014) Verbindung herstellen - Trennendes überbrücken. Mit jedermann, jederzeit und überall eine gemeinsame Ebene finden. Praktische GFK für den Alltag. Junfermann • Dietz, Angela. (2015) Macht ohne Machtwort. Verantwortung übernehmen, Potenziale entfalten. Business Village • Miyashiro, Marie R. (2013) Der Faktor Empathie. Ein Wettbewerbsvorteil für Teams und Organisationen. Junfermann • Brüggemeier, Beate. (2010) Wertschätzende Kommunikation im Business. Wer sich öffnet, kommt weiter. Wie Sie die GFK im Berufsalltag nutzen. Junfermann • Heim, Vera und Lindemann, Gabriele. (2016) Beziehungskompetenz im Beruf. Brücken bauen mit Empathie und Gewaltfreier Kommunikation. Haufe Taschen Guide English: • Rosenberg, Marshall B., Ph.D. (3rd Edition 2015) Nonviolent Communication: A Language of Life. Create your Life, your Relationships, and your World in Harmony with your Values. Puddledancer Press • Connor, Jane, Ph.D. and Killian, Dian, Ph.D. (2nd edition 2012) Connecting Across Differences: Finding Common Ground with Anyone, Anywhere, Anytime. Puddledancer Press • Miyashiro, Marie R. (2011) The Empathy Factor. Your Competitive Advantage for Personal, Team and Business Success. Puddledancer Press • Roele, Hugo and Rich-Tolsma, Matthew, Drs. (2015) The Book of Needs. A Structural Model for Listening. Kommunikasie.nl • Kashtan, Miki. (2014) Reweaving our Human Fabric. Working Together to Create a Nonviolent Future. Fearless Heart Publications

Course L2345: Theory, Research and Practice of University Teaching	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Fachtheoretisch-fachpraktische Arbeit
Examination duration and scale	Schriftliche Ausarbeitung (in mehreren Teilen) sowie eine Präsentation
Lecturer	Prof. Christian Kautz, Jenny Alice Rohde
Language	DE
Cycle	WiSe/SoSe
Content	This course covers theory and practice of being a student teaching assistant in small-group instructional settings at TUHH. As part of the seminar, the participants have the opportunity to reflect on their work, e. g. through mutual observation and discussion.

	For prior knowledge / the event requirements: This event requires basic first work / collaboration experiences in the academic work structures of a higher education institution, which Master's students have acquired as part of the qualification for the Bachelor's degree at a university. These presumed work experiences include specific self-study experiences at a college. These are picked up, reflected, expanded and further developed both theoretically and practically with regard to learning from and in groups and later guiding this learning process. Furthermore, experiences with different types of learning / group types of higher education, which are part of a degree program acquired during the bachelor's program, are assumed, taken up, reflected on, expanded and further developed here in the master's program. The course also requires basic knowledge of presenting scholarly work results obtained by Master's students with a Bachelor's degree. In the course, this experience with and in representation in a group situation will be expanded and further developed in the direction of students' involvement with their own role as well as their design in face-to-face interaction as well as in group processes, learning and leadership situations, as masters graduates Graduate unlike bachelor graduates professionally stronger in a moderating role and with the guidance of humans because with the guidance in subject matters are demanded. According to the later professional role, the work of the seminar promotes and enables graduate students significantly more than graduates' qualifications for independent work and learning, transferring what they have learned to new areas, contributing, involving discussion and contributing their own examples and interests.
Literature	**Auszüge aus Fachliteratur zu oben genannten Themen werden in der Veranstaltung ausgegeben.** Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman. Bosse, E. (2016). Herausforderungen und Unterstützung für gelingendes Studieren: Studienanforderungen und Angebote für den Studieneinstieg. In I. van den Berk, K. Petersen, K. Schultes, & K. Stolz (Hrsg.). Studierfähigkeit - theoretische Erkenntnisse, empirische Befunde und praktische Perspektiven (Bd. 15). (S.129-169). Hamburg: Universität Hamburg. Collins, D. & Holton, E. (2004). The effectiveness of managerial leadership development programs: A meta-analysis of studies from 1982 to 2001. Human resource development quarterly, 15(2), 217 - 248. Danielsiek, H., Hubwieser, P., Krugel, J., Magenheim, J., Ohrndorf, L., Ossenschmidt, D., Schaper, N. & Vahrenhold, J. (2017). Verbundprojekt KETTI: Kompetenzerwerb von Tutorinnen und Tutoren in der Informatik. In A. Hanft, F. Bischoff, B. Prang (Hrsg.), Working Paper Lehr-/Lernformen. Perspektiven aus der Begleitforschung zum Qualitätspakt Lehre. Abgerufen von KoBF: Freeman, S., Eddy, SL., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H. & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematic. Proceedings of the National Academy of Sciences 11(23), 8410-8415. Glathe, A. (2017). Effekte von Tutorentraining und die Kompetenzentwicklung von MINTFachtutor* innen in Lernunterstützungsfunktion. (Nicht veröffentlichte Dissertation). Technische Universität Darmstadt, Deutschland. Kirkpatrick, D. L. (1959). Techniques for Evaluation Training Program. Journal of the American Society of Training Directors, 13, 21-26. Hänze, M. Fischer, E. Schreiber, Biehler, R. & Hochmuth, R- (2013). Innovationen in der Hochschullehre: empirische Überprüfung eines Studienprogramms zur Verbesserung von vorlesungsbegleitenden Übungsgruppen in der Mathematik. Zeitschrift für Hochschulentwicklung, 8(4), 89- 103. Kröpke, H. (2014). Who is who? Tutoring und Mentoring - der Versuch einer begrifflichen Schärfung. In D. Lenzen & H. Fischer (Hrsg.), Tutoring und Mentoring unter besonderer Berücksichtigung der Orientierungseinheit (Bd. 5). (21-29). Hamburg: Universitätskolleg-Schriften. Kühlmann, T. (2007). Fragebögen. In J. Straub, A. Weidemann & D. Weidemann (Hrsg.), Handbuch interkulturelle Kommunikation und Kompetenz (346-352). Stuttgart: Metzler. Mayring, P. (2010). Qualitative Inhaltsanalyse. Grundlagen und Techniken (11. aktualisierte und überarbeitete Auflage). Weinheim/Basel: Beltz.

	Mummendey, H. D. (1981). Methoden und Probleme der Kontrolle sozialer Erwünschtheit (Social Desirability). Zeitschrift für Differentielle und Diagnostische Psychologie, 2, 199-218. Rohde, J. & Block, M. (2018). Welche Herausforderungen und Bewältigungsstrategien berichten Tutor/innen der Ingenieurwissenschaften? Eine explorative Analyse von Reflexionsberichten. Vortrag auf der 47. Tagung der Deutschen Gesellschaft für Hochschuldidaktik, Karlsruhe. Heterogenität der Studierenden und Lösungsansätze von Tutor/-innen Jenny Alice Rohde. Posterpräsentation auf der Tagung “Tutorielle Lehre und Heterogenität”. Technische Universität Darmstadt, 16.05.2019.Hochschuldidaktische Tutorenqualifizierung - Eine Basisqualifizierung des akademischen Nachwuchses und Chance für den Wandel der Lehr-/Lernkultur? Jenny Alice Rohde & Caroline Thon-Gairola. Posterpräsentation auf der DGHD am 07.03.2019.Welches Lehrverhalten zeigen geschulte Tutor/innen? Eine explorative Analyse selbst- und fremdwahrnehmungsbasierter Reflexionsberichte Jenny Alice Rohde & Nadine Stahlberg. In: die hochschulehre (2019). Schneider, M. & Preckel, F. (2017). Variables associated with achievement in higher education: A systematic review of meta-analyse. Psychological Bulletin, 143(6), 565-600. Skylar Powell, K. & Yalcin, S. (2010). Managerial training effectiveness: A meta-analysis 1952-2002. Personnel Review, 39(2), 227-241. 27 Welches Lehrverhalten zeigen geschulte Tutor/innen d ie hochs chul l ehre 2019 www.hochschullehre.org Stes, A., Min-Leliveld, M., Gijbels, D. & Van Petegem, P. (2010). The impact of instructional development in higher education: The state-of-the-art of the research. Educational Research Review, 5(1), 25-49. Stroebe, W. (2016). Why Good Teaching Evaluations May Reward Bad Teaching: On Grade Inflation and Other Unintended Consequences of Student Evaluation. Perspectives on Psychological Science, 11(6), 800-816. Technische Universität Hamburg (2018). Kennzahlen 2017. Hamburg: Technische Universität Hamburg. [https://www.tuhh.de/tuhh/uni/informationen/kennzahlen.html] Thumser-Dauth, K. (2008). Und was bringt das? Evaluation hochschuldidaktischer Weiterbildung. In B. Berendt, H.-P. Voss & J. Wildt (Hrsg.), Neues Handbuch Hochschullehre. Lehren und Lernen effizient gestalten. Kap. L 1.11 Hochschuldidaktische Aus- und Weiterbildung. Veranstaltungskonzepte und -modelle. Berlin: Raabe. S. 1-10. Wibbecke, G. (2015): Evaluation einer hochschuldidaktischen Weiterbildung an der Medizinischen Fakultät Heidelberg. Dissertation. Ruprecht-Karls-Universität Heidelberg. Willige, J., Woisch, A., Grützmacher, J. & Naumann, H. (2015a). Randauszählung Studienqualitätsmonitor 2014, Technische Universität Hamburg-Harburg, Online-Befragung Studierender im Sommersemester 2014, DZHW - Deutsches Zentrum für Hochschul- und Wissenschaftsforschung. Willige, J., Woisch, A., Grützmacher, J. & Naumann, H. (2015b). Randauszählung Studienqualitätsmonitor 2015, Technische Universität Hamburg-Harburg, Online-Befragung Studierender im Sommersemester 2015, DZHW - Deutsches Zentrum für Hochschul- und Wissenschaftsforschung. Winkler, M. (2018). Tutorielle Lehransätze im Vergleich. Die KOMPASS Begleitforschung. Vortrag gehalten am 12.03.2018 auf dem Netzwerktreffen Tutorienarbeit an Hochschulen in Würzburg. Zech, F. (1977). Grundkurs Mathematikdidaktik: theoretische und praktische Anleitungen für das Lehren und Lernen im Fach Mathematik. Weinheim: Beltz.

Course L1509: Intercultural Communication	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Prof. Margarete Jarchow, Anna Katharina Bartel
Language	EN
Cycle	WiSe/SoSe
Content	As young professionals with technical background you may often tend to focus on communicating numbers and statistics in your presentations. However, facts are only one aspect of convincing others. Often, your personality, personal experience, cultural background and emotions are more important. You have to convince as a person in order to get your content across. In this workshop you will learn how to increase and express your cultural competence. You will apply cultural knowledge and images in order to positively influence communicative situations. You will learn how to add character and interest to your talks, papers and publications by referring to your own and European Cultural background. You will find out the basics of communicating professionally and convincingly by showing personality and by referring to your own cultural knowledge. You will get hands-on experience both in preparing and in conducting such communicative situations. This course is not focussing on delivering new knowledge about European culture but helps you using existing knowledge or such that you can gain e.g. in other Humanities courses. Content • How to enrich the personal character of your presentations **by referring to European and your own culture** • How to properly arrange **content and structure.** • How to use **PowerPoint for visualization** (you will use computers in an NIT room). • How to be well-prepared and convincing **when delivering** your thoughts to your audience**.**
Literature	Literaturhinweise werden zu Beginn des Seminars bekanntgegeben. Literature will be announced at the beginning of the seminar.

Course L2015: Intercultural Management - Theory and Awareness Training	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	15 Minuten Vortrag und dessen schriftliche Ausarbeitung (10 Seiten)
Lecturer	Prof Jürgen Rothlauf
Language	EN
Cycle	WiSe/SoSe
Content	The subject of the course is the deepening of the intercultural dimension of international management in relation to fundamental challenges, the importance of culture in team work and leadership of large multinational companies. In addition, culture-awareness trainings are discussed and carried out.
Literature	Rothlauf, J (2014): A Global View on Intercultural Management - Challenges in a Globalized World, De Gruyter Oldenbourg Verlag, 360 p

Course L2346: Young, educated, (non)political - are our young engineers well prepared for the future?	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Vincent-Immanuel Herr
Language	DE
Cycle	WiSe/SoSe
Content	Digitalization, climate change, democracy - society is facing fundamental upheavals. The next generation of young engineers in particular must no longer remain out of debate and can provide answers to the big questions of our time. Why is social commitment important? Is studying preparing us well for the future? What needs to improve? In the interactive workshop, the participants will be accompanied in analyzing their own generation and their own actions and in developing thesis on how to improve technical studies and training. The result of the seminar will be a joint thesis paper.
Literature	Wird im Seminar bekannt gegeben.

Course L2176: Culture of Communication - Theories and Methods of Successful Communication	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Anna Katharina Bartel
Language	DE
Cycle	WiSe/SoSe
Content	This course is for master students. In this seminar, we will explore different theories, models and methods from the fields of communication, psychology and cultural theory. The participants will work on theoretical content and do group presentations. They will also use examples from their own experiences to apply models and methods in practical exercises. The way we communicate shapes the way we experience our relationships, in the business world as well as in our private lives. We spend an overwhelming amount of time in group situations. This makes it worthwhile to explore how communication works within the group context and how, within these different groups, different cultures of communication develop. This particularly applies in highly specialized fields, such as engineering. Our ability to flexibly and successfully move from one context to another helps us along in building successful careers and allows us to feel positive about our private lives. However, this is not always simple. For example: If we are part of a context in which many conflicts arise If we have to switch between different contexts frequently Or if, on the one hand, complicated facts and data are our main focus but on the other hand, we have to communicate them to people who are not familiar with the subject. Maybe we even have to win their attention in order to help along our causes. Oftentimes, this leads to misunderstandings. There also might be a lack of openness or willingness to embrace conflict. This might make it difficult for us to reach our goals. To be able to reflect on the way we communicate, to identify patterns of communication and the ability to actively build positive relationships through communication are useful skills to help overcome those obstacles..
Literature	• Knoblauch, H. (1995). Kommunikationskultur: Die kommunikative Konstruktion kultureller Kontexte (Materiale Soziologie, Band 5). de Gruyter. • Geert Hofstede, Geert Jan Hofstede, Michael Minkov. (2010). Cultures and Organizations - Software Of The Mind:Intercultural Cooperation and Its Importance for Survival. McGraw-Hill Education. • Bay, Rolf H. (2006) Erfolgreiche Gespräche durch aktives Zuhören. Ehningen. Expert-Verlag. • Cohn, Ruth (1975). Von der Psychoanalyse zur Themenzentrierten Interaktion. Stuttgart. Klett - Cotta • Fengler, Jörg (1998) Feedback geben. Weinheim. Beltz. • Lumma, Klaus (2006). Die Teamfibel oder das Einmaleins der Team- & Gruppenqualifizierung im sozialen und betrieblichen Bereich. Windmühle. • Spies, Stefan. (2010). Der Gedanke lenkt den Körper: Körpersprache - Erfolgsstrathegien eines Regisseurs. Hoffmann und Campe.

Course L0535: Theory of Communication	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	20-30 Minuten Referat und Thesenpapier
Lecturer	Dr. Michael Florian
Language	DE
Cycle	SoSe
Content	The seminar focuses on sociological theories of communication and selected problems of practical application in the area of crisis communication. The issue of crisis communication will be analyzed on the basis of case studies.
Literature	Habermas, Jürgen (1981): Theorie des kommunikativen Handelns. 2 Bände. Frankfurt/Main: Suhrkamp. Luhmann, Niklas (1984): Soziale Systeme. Grundriß einer allgemeinen Theorie. Frankfurt/Main: Suhrkamp. Malsch, Thomas (2005): Kommunikationsanschlüsse. Zur soziologischen Differenz von realer und künstlicher Sozialität. Wiesbaden: VS Verlag für Sozialwissenschaften. Malsch, Thomas; Schmitt, Marco (Hg.) (2014): Neue Impulse für die soziologische Kommunikationstheorie. Empirische Widerstände und theoretische Verknüpfungen. Springer Fachmedien: Wiesbaden. Meckel, Miriam; Schmid, Beat F. (Hg.) (2008): Unternehmenskommunikation. Kommunikationsmanagement aus Sicht der Unternehmensführung. 2., überarbeitete und erweiterte Auflage. Gabler GWV Fachverlage: Wiesbaden. Merten, Klaus (1999): Einführung in die Kommunikationswissenschaft. Bd 1/1: Grundlagen der Kommunikationswissenschaft. Münster: Lit Verlag. Nolting, Tobias; Thießen, Ansgar (Hg.) (2008): Krisenmanagement in der Mediengesellschaft. Potenziale und Perspektiven der Krisenkommunikation. Wiesbaden: VS Verlag für Sozialwissenschaften. Schützeichel, Rainer (2004): Soziologische Kommunikationstheorien. Konstanz: UVK Verlagsgesellschaft. Thießen, Ansgar (2011): Organisationskommunikation in Krisen. Reputationsmanagement durch situative, integrierte und strategische Krisenkommunikation. VS Verlag für Sozialwissenschaften/Springer Fachmedien: Wiesbaden. Thießen, Ansgar (Hg.) (2013): Handbuch Krisenmanagement. Springer Fachmedien: Wiesbaden.

Course L1732: criminology and society - in German	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	Gruppenreferat (30 bis 45 Minuten, Eigenanteil je Person 10 bis 15 Minuten) inkl. schriftlicher Ausarbeitung, Ggf. alternativ eine längere, schriftliche Ausarbeitung.
Lecturer	Sarah Schirmer
Language	DE
Cycle	WiSe/SoSe
Content	The seminar will provide an overview of Criminology and introduce different theories of criminality. It is necessary to consider the discipline of Criminology within its historical context in order to understand how some theories have evolved. The students will use this knowledge of Criminology theory to discuss and consider the advantages and disadvantages of each theory. Discussions will include how society constructs crime as well as a more philosophical debate about a determined view.
Literature	Wird zeitnah bekannt gegeben. Will be announced in lecture.

Course L2369: Literature and Culture for international students of Master's degree programs in English (non-native speakers of German)	
Typ	Seminar
Hrs/wk	4
CP	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Examination Form	Referat
Examination duration and scale	45 min. Präsentation und anschließende Diskussion
Lecturer	Bertrand Schütz
Language	DE
Cycle	WiSe/SoSe
Content	The seminar LITERATURE AND CULTURE investigates what culture is, especially what characterises epistemic cultures. Culture is to be understood as the creative response to a given situation and the capacity to integrate inputs and influences, therefore as an ongoing process of permanent readjustment and learning, and by no means as a fixed identity in terms of an “essence”. There is a growing awareness that Europe cannot lay claim to possess the ultimate standards of knowledge. A topography of our contemporary world is to be sketched by highlighting its historical and cultural premises. For more information please refer to the German description and the StudIP.
Literature	Je nach Thematik des Semesters wird eine spezifische Literatur-Liste erstellt. cf. StudIP

Course L1837: People in Business Organizations	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	Schriftliche Hausarbeit 7-10 Textseiten; verpflichtend: Präsentation der Zwischenergebnisse mit Diskussion (geht nicht in die Bewertung mit ein)
Lecturer	Dr. Martin Schütz
Language	DE
Cycle	WiSe/SoSe
Content	The influence of technological change and social change on business organizations - how to manage the organizational change.
Literature	Becker, Karen Louise (2007): Unlearning in the workplace. A mixed methods study. PhD. Queensland University of Technology, Brisbane. Faculty of Education. Online verfügbar unter http://eprints.qut.edu.au/16574/. Frey, Dieter; Gerkhardt, Marit; Peus, Claudia; Traut-Mattausch, Eva; Fischer, Peter (2014): Veränderungen managen. Widerstände und Erfolgsfaktoren der Umsetzung. In: Lutz von Rosenstiel, Erika Regnet und Michel E. Domsch (Hg.): Führung von Mitarbeitern. Handbuch für erfolgreiches Personalmanagement. 7. Aufl. Stuttgart: Schäffer-Poeschel, S. 547-559. Hauser, Berndhard (2014): Konflikte in und zwischen Gruppen. In: Lutz von Rosenstiel, Erika Regnet und Michel E. Domsch (Hg.): Führung von Mitarbeitern. Handbuch für erfolgreiches Personalmanagement. 7. Aufl. Stuttgart: Schäffer-Poeschel, S. 354-367. Kieser, Alfred; Walgenbach, Peter (2007): Organisation. 5. Aufl. Stuttgart: Schäffer-Poeschel. Miebach, Bernhard (2012): Organisationstheorie. Problemstellung - Modelle - Entwicklung. 2. Aufl. Wiesbaden: Springer Fachmedien Wiesbaden; Imprint: Springer VS. Müller, Ursula (Hg.) (2013): Geschlecht und Organisation. Wiesbaden: Springer VS (Geschlecht und Gesellschaft, 45). Olfert, Klaus (2012): Organisation. 16. Aufl. Herne: NWB Verlag. Pohlmann, Markus; Markova, Hristina (2011): Soziologie der Organisation. Eine Einführung. Konstanz, München: UVK-Verl.-Ges. (3573). Preisendörfer, Peter (2011): Organisationssoziologie. Grundlagen, Theorien und Problemstellungen. 3. Aufl. Wiesbaden: VS Verlag für Sozialwissenschaften. Robbins, Stephen P.; Judge, Timothy A. (2013): Organizational Behavior. 15. Aufl. Boston, Mass: Pearson. Rosenstiel, Lutz von; Nerdinger, Friedemann W. (2011): Grundlagen der Organisationspsychologie. Basiswissen und Anwendungshinweise. 7. Aufl. Stuttgart: Schäffer-Poeschel. Sanders, Karin; Kianty, Andrea (2006): Organisationstheorien. Eine Einführung. 1. Aufl. Wiesbaden: VS Verlag für Sozialwissenschaften. Schreyögg, Georg (2008): Organisation. Grundlagen moderner Organisationsgestaltung, mit Fallstudien. 5. Aufl. Wiesbaden: Gabler (Lehrbuch). Vahs, Dietmar (2012): Organisation. Ein Lehr- und Managementbuch. 8. Aufl. Stuttgart: Schäffer-Poeschel. Weinert, Ansfried B. (2004): Organisations- und Personalpsychologie. 5. Aufl. Weinheim: BeltzPVU.

Course L1846: Classical Journalism and New Media	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	Ca. 20 min. plus anschließende Diskussion
Lecturer	Dieter Bednarz
Language	DE
Cycle	WiSe/SoSe
Content	The world wide walkover of the internet dramatically changed the perception of classical media like newspapers, magazines and even TV. In this seminar the reasons of and the consequences for the dramatic changes regarding our information habits will be analyzed and discussed. Has the media expert Neil Postman been right, when he one said, that we all one day will be „overnewsed but underinformed“? Keeping a close eye on the real challenges of journalism, the seminar will discuss the standards of ethics in politics and media.
Literature	Wird im Seminar genannt

Course L1023: Politics	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Stephan Albrecht
Language	EN
Cycle	WiSe/SoSe
Content	Scientists and engineers neither just strive for truths and scientific laws, nor are they working in a space far from politics. Science and engineering have contributed to what we now call the Anthropocene, the first time in the history of mankind when essential cycles of the earth system, e.g. carbon cycle, climate system, are heavily influenced or even shattered. Furthermore, Peak oil is indicating the end of cheap fossil energy thus triggering the search for alternatives such as biomass. Systems of knowledge, science and technology in the OECD countries have since roughly 30 years increasingly become divided. On the one hand new technologies such as modern biotechnology, IT or nanotechnology are developing rapidly, bringing about many innovations for industry, agriculture, and consumers. On the other hand scientific studies from earth, environmental, climate change, agricultural and social sciences deliver increasingly robust evidence on more or less severe impacts on society, environment, global equity, and economy resulting from innovations during the last 50 years. Technological innovation thus is no longer an uncontested concept. And many protest movements demonstrate that the introduction of new or the enlargement of existing technologies (e.g. airports, railway stations, highways, high-voltage power lines surveillance) isn't at all a matter of course. It is important to bear in mind the fact that all processes of technological innovation are made by humans, individually and collectively. Industrial, social, and political organizations as actors from the local to global level of communication, deliberation, and decision making interact in diverse arenas, struggling to promote their respective corporate and/or political agenda. So innovations are as well a problem of technology as a problem of politics. Innovation and technology policies aren't the same in all countries. We can observe conceptual and practical variations. Since the 1992 Earth Summit in Rio de Janeiro Agenda 21 constitutes a normative umbrella, indicating Sustainable Development (SD) as core cluster of earth politics on all levels from local to global. Meanwhile other documents such as the Millennium Development Goals (MDG) have complemented the SD agenda. SD can be interpreted as operationalization of the Universal Declaration of Human Rights, adopted in 1948 by the General Assembly of the United Nations and since amended many times. Engineers and scientists as professionals can't avoid to become confronted with many non-technical and non-disciplinary items, challenges, and dilemmas. So they have to choose between alternative options for action, as individuals and as members of organizations or employees. Therefore the seminar will address core elements of the complex interrelations between science, society and politics. Reflections on experiences of participants - e.g. from other countries as Germany - during the seminar are very welcome. The goals of the seminar include: • Raising awareness and increasing knowledge about the political implications of scientific work and institutions; • Improving the understanding of different concepts and designs of innovation and technology policies; • Increasing knowledge about the status and perspectives of sustainable development as framework concept for technological and scientific progress; • Understanding core elements of recent arguments, conflicts, and crises on technological innovations, e.g. geo-engineering or bio-economy; • Improving the understanding of scientists' responsibility for impacts of their professional activities; • Embedding individual professional responsibility in social and political contexts. The seminar will deal with current problems from areas such as innovation policy, energy, food systems, and raw materials. Issues will include the future of energy, food security and electronics. Historical issues will also be addressed. The seminar will start with a profound overarching introduction. Issues will be introduced by a short presentation and a Q & A session, followed by group work on selected problems. All participants will have to prepare a presentation during the weekend seminar. The seminar will use inter alia interactive tools of teaching such as focus groups, simulations and presentations by students. Regular and active participation is required at all stages.
Literature	Literatur wird zu Beginn des Seminars abgesprochen.

Course L1856: Politics and Science - in German	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	Referat ca. 20 min. plus anschließende Diskussion
Lecturer	Dr. Mirko Himmel, Dr. Ines Krohn-Molt
Language	DE
Cycle	WiSe/SoSe
Content	Scientists often like to believe that their work is non-political. Within this seminar we want to demonstrate how deeply both are interconnected and converged. Not only, scientific guidance is often needed to take a political decision but also scientific outcomes are a sub-ject to political interpretation. Also, politics are significantly influencing scientific progress by framing research agendas and by funding decisions.
Literature	Wird im Seminar genannt

Course L1779: Politics and Science - in English	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Frederik Postelt, Dr. Gunnar Jeremias
Language	EN
Cycle	WiSe/SoSe
Content	Scientists often like to believe that their work is non-political. Within this seminar we want to demonstrate how deeply both are interconnected and converged. Not only, scientific guidance is often needed to take a political decision but also scientific outcomes are a sub-ject to political interpretation. Also, politics are significantly influencing scientific progress by framing research agendas and by funding decisions. During this seminar we would like to show the different range of influences - scientific, economic, social, environmental, ethical/normative, security-related - affecting decision-making on science and politics. Using case studies on current debates on food security, public health, nuclear energy and terrorism to discuss the interrelation between science and politics illuminating the role of various actors in this process, such as: • Governments, • International organizations, • Scientific associations, • Industry, • Civil society, and • Individual scientists. The guiding questions will be: • How does and should science influence politics? • How does and should politics influence science? In order to take responsibility for the consequences of scientific work, engineers and scientists increasingly need to acknowledge the political dimension of their work and their role in the political process. We will address this political dimension of scientific work by discussing: • Biographies and motivations of famous scientists, • Individual responsibility of scientists for the implications of their work, and • The role of codes of conduct as guidelines for responsible behaviour. The goals of the seminar include: • Raising awareness and increasing knowledge about the political dimensions of scientific work, • Providing guidelines for evaluating political implications of scientific research, • Improving the understanding of scientists' and engineers' responsibility for the results of their professional activities, • Taking decisions at the institutional, national and international level about rules and regulations concerning scientific conduct, and • Choosing arguments and defending positions in situations of conflicting interests. The seminar will use current issues, such as dilemmas in the life sciences or bio fuels to demonstrate the problematic relationship between science and politics. The seminar, however, does not focus on providing in-depth knowledge of these current issues. We strongly discourage students that have participated in an “Ethics for Engineers” seminar to take this course, because the contents of the two seminars overlap. Issues will be introduced by short presentations and a Q&A session, followed by group work on selected problems. All participants will have to prepare a presentation. Those requiring a graded certificate (“Schein”) additionally have to write a 3-4 page paper on selected issues. The seminar will use interactive tools of teaching such as role playing and simulations. Group work and active participation is expected at all stages of the seminar.
Literature	will be announced in lecture wird im Seminar bekannt gegeben

Course L1734: Projectrealisation: TUHH goes circular - Sustainability in Research, Education and campus management	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe/SoSe
Content	
Literature	Wird im Seminar bekanntgegeben Will be announced in lecture.

Course L1872: Social Learning: Social Commitment in Refugee Issues / Master	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	10 Seiten
Lecturer	Muthana Al-Temimi
Language	DE
Cycle	WiSe/SoSe
Content	folgt
Literature	Wird im Seminar bekannt gegeben. Will be announced in lecture.

Course L1647: Soft skill seminar for dual study programme (dual@TUHH) / Master	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	Referat mit 2-3 Videoübungen à 20 Minuten + anschließende Diskussion
Lecturer	Silke Wolckenhaar-Wagner, Dr. Henning Haschke
Language	DE
Cycle	WiSe/SoSe
Content	
Literature	

Course L1771: The Arabic Spring an its Consequences	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dieter Bednarz
Language	DE
Cycle	WiSe/SoSe
Content	The world wide walkover of the internet dramatically changed the perception of classical media like newspapers, magazines and even TV. In this seminar the reasons of and the consequences for the dramatic changes regarding our information habits will be analyzed and discussed: Taking a close look at the Middle East the political impact of the new media´s triumphal procession will be assessed and evaluated. How come that Twitter and Facebook on one hand facilitated the so called Arabic Spring and caused hope for the rise of democracy in the region, while on the other hand the revolutionaries failed so dramatically - at least for now. Keeping a close eye on both fields, the Media and the Middle East, the seminar will discuss the standards of ethics in politics and journalism.
Literature	Wird im Seminar angegeben und besprochen. Will be announced in the lecture.

Course L1916: Responsible Conduct in Technology & Science	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Mirko Himmel, Dr. Ines Krohn-Molt
Language	DE
Cycle	WiSe/SoSe
Content	Aim of the seminar is raising awareness for the responsibility of engineers and researchers for a proper and ethical conduct in technology and science. The Participants will present and discuss practical examples for good as well as bad conduct in science.
Literature	folgt im Seminar

Course L1991: What can philosophy do?	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Ursula Töller
Language	DE
Cycle	WiSe/SoSe
Content	Over the centuries, the philosophy is lined up as a discipline that provides complex and universal answers to contemporary history and circumstances. Often, she could design utopias that have led the way for political upheaval. While all scientific disciplines are subject to an increasing differentiation, the philosophy in the second half of the 20th century has lost its claim to universality. But what then are the topics of the philosophy of the 20th and 21st century and what impact have philosophical theories for processes of change? We will provide an overview of Western philosophies of the 20th and 21st century. and take a critical look at the self-understanding of philosophy.
Literature	Gerhardt Schweppenhäuser: Kritische Theorie, Stuttgart 2010 Postmoderne und Dekonstruktion, Texte französischer Philosophen der Gegenwart, hrsg. von Peter Engelmann, Reclam UB 8668 Thomas Rentsch: Philosophie des 20. Jhdts. Von Husserl bis Derrida, München 2014 Geschichte der Philosophie in Text und Darstellung, Bd. 8=20 Jhdt. Reclam UB 9918 Geschichte der Philosophie in Text und Darstellung, Bd. 9= Gegenwart Reclam UB 18267

Course L2343: Academic Writing and Presentation for Master-Students	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	etwa 20 Minuten Präsentation und 10-20 Minuten Diskussion
Lecturer	Dr. Ursula Töller
Language	DE
Cycle	WiSe/SoSe
Content	The course is aimed at Master students who are planning to write their thesis, want to pursue their PhD or intend to present their research results at conferences and in journals. The course is structured on three levels: 1. writing, 2. presenting and 3. interacting in organizational structures. The latter refers to the work environment at university as well as in research groups and enterprises. In the course of the seminar, the participants become acquainted with various methods and theories on the subject. Furthermore, the methods and theories will be put into practice, reflected upon and discussed as part of the seminar.
Literature	• Umberto Eco, Wie man eine wiss. Abschlussarbeit schreibt (2010) • Helga Esselborn-Krumbiegel, Von der Idee zum Text. Eine Anleitung zum wissenschaftlichen Schreiben (2008) • Tony Buzan: Das Mind-Map-Buch. (2001) • John W. Chinneck: How to organize your Thesis (1999) • Lothar Seiwert: Das neue 1x1 des Zeitmanagements (2003) • Steven R. Covey: Die sieben Wege der Effektivität (2000) • Harold Kerzner: Twenty Common Mistakes Made by New or Inexperienced Project Manager (2010) • Friedemann Schulz von Thun: Miteinander Reden. (1996) Tim McClintock: Dealing with Specific Types of Difficult People. (2008)

Course L2029: “Lying press”? Functions and current challenges of journalism	
Typ	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	20 min
Lecturer	Prof. Horst Pöttker
Language	DE
Cycle	WiSe/SoSe
Content	Lying press - there is a revival of the disparaging invective. Journalists use to shoot it down by leading it back to its supposed roots in the NS-propaganda. This is less convincing as several parties and ideologies have used it since the middle of the 19th century to discredit the media of other parties and ideologies. And it is missing the core of the problem. Critics are reasonably afraid that the choice of “lying press” to the “non-word of the year” 2014 has blocked the question, if there is a justified criticism of information media and journalism - or more precisely of the relationship between journalism and its audience. If this is the case both - journalism and audience - are involved from the perspective of inter actionism. Against this background interactive instructions will be given by scholarly literature and practical examples from the German and international media business. Questions like the following will be discussed: • Is journalism really a profession? If so - since when? • What is journalism for? (task and duties, functions, self-images) • Do the audience and journalists themselves have a reasonable understanding of tasks, functions, practices, problems of journalism? • What is the current concept of journalistic professionalism? Has it ever been the same? • From an international perspective: Does journalism in Germany have special shortcomings - if so, how can they be removed? • What are the economic challenges for journalism from the digital media upheaval? • In which direction do journalistic professionalism and self-understanding change in the digital media world? Objective is solid learning about professional tasks, ethics, techniques, endagerments, history and current problems of journalism including science journalism.
Literature	Zur Einführung: Lilienthal, Volker/Neverla, Irene (Hrsg.) (2017): „Lügenpresse“. Anatomie eines politischen Kampfbegriffs. Köln: Kiepenheuer & Witsch. https://www.kiwi-verlag.de/buch/luegenpresse/978-3-462-31782-4/ Pöttker, Horst (2010): Der Beruf zur Öffentlichkeit. Über Aufgabe, Grundsätze und Perspektiven des Journalismus in der Mediengesellschaft aus der Sicht praktischer Vernunft. In: Publizistik, 55. Jg., H. 2, S. 107-128. https://www.springerprofessional.de/en/der-beruf-zur-oeffentlichkeit/5889108 Weischenberg, S. (2007): Das *Jahrhundert des Journalismus* ist vorbei. Rekonstruktionen und Prognosen zur Formation gesellschaftlicher Selbstbeobachtung. In: *Bartelt-Kircher*, G. et al.: Krise der Printmedien - eine Krise des Journalismus? Berlin und New York, de Gruyter Saur, S. 32-60. https://medien21.wordpress.com/2011/10/17/weischenberg-das-jahrhundert-des-journalismus-ist-vorbei/ Eine ausführliche Literaturliste wird am Anfang des Seminars verteilt.

Module M0808: Finite Elements Methods

Courses

Title	Typ	Hrs/wk	CP
Finite Element Methods (L0291)	Lecture	2	3
Finite Element Methods (L0804)	Recitation Section (large)	2	3

Module Responsible	Prof. Otto von Estorff
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	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students possess an in-depth knowledge regarding the derivation of the finite element method and are able to give an overview of the theoretical and methodical basis of the method.
Skills	The students are capable to handle engineering problems by formulating suitable finite elements, assembling the corresponding system matrices, and solving the resulting system of equations.
Personal Competence	
Social Competence	Students can work in small groups on specific problems to arrive at joint solutions.
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 Lecture 56
Credit points	6
Course achievement	**Compulsory** No, **Bonus** 20 %, **Form** Midterm, **Description**
Examination	Written exam
Examination duration and scale	120 min
Assignment for the Following Curricula	Civil Engineering: Core Qualification: Compulsory Energy Systems: Core Qualification: Elective Compulsory Aircraft Systems Engineering: Specialisation Aircraft Systems: Elective Compulsory Aircraft Systems Engineering: Specialisation Air Transportation Systems: Elective Compulsory Aircraft Systems Engineering: Specialisation Aircraft Systems: Elective Compulsory Aircraft Systems Engineering: Specialisation Air Transportation Systems: Elective Compulsory International Management and Engineering: Specialisation II. Mechatronics: Elective Compulsory International Management and Engineering: Specialisation II. Product Development and Production: Elective Compulsory International Management and Engineering: Specialisation II. Mechatronics: Elective Compulsory International Management and Engineering: Specialisation II. Product Development and Production: Elective Compulsory 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: Specialisation III. Engineering Science: Elective Compulsory Theoretical Mechanical Engineering: Core Qualification: Compulsory

Course L0291: Finite Element Methods	
Typ	Lecture
Hrs/wk	2
CP	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, K.-J. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin

Course L0804: Finite Element Methods	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Module M0962: Sustainability and Risk Management

Courses

Title	Typ	Hrs/wk	CP
Safety, Reliability and Risk Assessment (L1145)	Seminar	2	3
Environment and Sustainability (L0319)	Lecture	2	3

Module Responsible	Prof. Kerstin Kuchta
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 describe single techniques and to give an overview for the field of safety and risk assessment as well as environmental and sustainable engineering, in detail: • basics in safety and reliability of technical facilities • safety and reliability analysis methods • risk assessment • Production and usage of bio-char • energy production and supply • sustainable product design
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, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Elaboration and presentation (45 minutes in groups)
Assignment for the Following Curricula	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

Course L1145: Safety, Reliability and Risk Assessment

Typ	Seminar
Hrs/wk	2
CP	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

Course L0319: Environment and Sustainability	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	This course presents actual methodologies and examples of environmental relevant, sustainable technologies, concepts and strategies in the field of energy supply, product design, 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
Literature	Wird in der Veranstaltung bekannt gegeben.

Specialization Coastal Engineering

Module M0699: Advanced Foundation Engineering and Soil Laboratory Course

Courses

Title	Typ	Hrs/wk	CP
Soil Laboratory Course (L0499)	Practical Course	1	2
Numerical Methods in Geotechnics (L0375)	Lecture	3	3
Advanced Foundation Engineering (L0497)	Lecture	2	2
Advanced Foundation Engineering (L0498)	Recitation Section (large)	1	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 82, Study Time in Lecture 98
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
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

Typ	Practical Course
Hrs/wk	1
CP	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 L0375: Numerical Methods in Geotechnics	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Hans Mathäus Stanford
Language	DE
Cycle	WiSe
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

Course L0497: Advanced Foundation Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0858: Coastal Hydraulic Engineering I

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Basics of Coastal Engineering (L0807)	Lecture	3	4
Basics of Coastal Engineering (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 reached the following learning results
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 Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.
Assignment for the Following 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

Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe

Content	• Basics of planning and design
	  ◦ Water levels
	  ◦ Currents
	  ◦ Waves
	  ◦ Ice
	• Planning and Design in Coastal Engineering
	  ◦ Functional and constructional design
	  ◦ Determination of design parameters
	  ◦ Design-approaches
	    ▪ Filter
	    ▪ Rubble mound constructions
	    ▪ Piles
	    ▪ Vertical constructions

Literature	Coastal Engineering Manual, CEM Vorlesungsumdruck

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

Module M0964: Structures in Foundation and Hydraulic Engineering

Courses

Title	Typ	Hrs/wk	CP
Applied Tunnel Constructions (L2407)	Lecture	2	3
Steel Structures in Foundation and Hydraulic Engineering (L1146)	Lecture	2	3
Underground Constructions (L0707)	Lecture	1	2
Underground Constructions (L1811)	Recitation Section (large)	1	1

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	Modules from Bachelor studies Civil and environmental engineering: • Geotechnics I-II • Steel Structures I-II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	Capacity for teamwork concerning project management and design of tunnels.
Autonomy	Promotion of independent and creative work flow in the framework of a design exercise.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 minutes
Assignment for the Following Curricula	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

Course L2407: Applied Tunnel Constructions

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe, Tim Babendererde
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1146: Steel Structures in Foundation and Hydraulic Engineering

Typ	Lecture
Hrs/wk	2
CP	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: Underground Constructions	
Typ	Lecture
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Marius Milatz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0511: Electricity Generation from Wind and Hydro Power

Courses

Title	Typ	Hrs/wk	CP
Renewable Energy Projects in Emerged Markets (L0014)	Project Seminar	1	1
Hydro Power Use (L0013)	Lecture	1	1
Wind Turbine Plants (L0011)	Lecture	2	3
Wind Energy Use - Focus Offshore (L0012)	Lecture	1	1

Module Responsible	Dr. Joachim Gerth
Admission Requirements	None
Recommended Previous Knowledge	Module: Technical Thermodynamics I, Module: Technical Thermodynamics II, Module: Fundamentals of Fluid Mechanics
Educational Objectives	After taking part successfully, students have reached the following learning results
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, students improve their understanding and the application of the theoretical background and are thus able to transfer what they have learned in practice.
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 multidisciplinary within 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
Course achievement	None
Examination	Written exam
Examination duration and scale	3 hours written exam
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 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: Elective Compulsory 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

<table>
<tr><th colspan="2">Course L0014: Renewable Energy Projects in Emerged Markets</th></tr>
<tr><td>Typ</td><td>Project Seminar</td></tr>
<tr><td>Hrs/wk</td><td>1</td></tr>
<tr><td>CP</td><td>1</td></tr>
<tr><td>Workload in Hours</td><td>Independent Study Time 16, Study Time in Lecture 14</td></tr>
<tr><td>Lecturer</td><td>Prof. Andreas Wiese</td></tr>
<tr><td>Language</td><td>DE</td></tr>
<tr><td>Cycle</td><td>SoSe</td></tr>
<tr><td>Content</td><td>

Introduction

Development of renewable energies worldwide

History
Future markets

Special challenges in new markets - Overview

Sample project wind farm Korea

Survey
Technical Description
Project phases and characteristics

Funding and financing instruments for EE projects in new markets

Overview funding opportunitie
Overview countries with feed-in laws
Major funding programs

CDM projects - why, how , examples

Overview CDM process
Examples
Exercise CDM

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

Tendering process for EE projects - examples

South Africa
Brazil

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.</td></tr>
<tr><td>Literature</td><td>Folien der Vorlesung</td></tr>
</table>

Course L0013: Hydro Power Use	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Achleitner
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Rudolf Zellermann, Dr. Jochen Oexmann
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	
Typ	Lecture
Hrs/wk	1
CP	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: Construction Processes

Courses

Title	Typ	Hrs/wk	CP
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 successfully, students have reached the following learning results
Professional Competence	
Knowledge	
Skills	
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 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 L1908: Digital Building

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Markus Salge
Language	DE
Cycle	SoSe
Content	
Literature	

Module M0593: Building Materials and Building Preservation

Courses

Title	Typ	Hrs/wk	CP
Repair of Structures (L0255)	Lecture	1	1
Mineral Building Materials (L0253)	Lecture	2	2
Technology of mineral Building Materials (L0256)	Project-/problem-based Learning	1	2
Transport Processes in Building Materials and Damage Processes (L0254)	Lecture	1	1

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	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 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 present 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** 20 %; **Form** Subject theoretical and practical work; **Description**
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 L0255: Repair of Structures

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Design and production of a special mineral building material
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis

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

Module M0723: Design of Prestressed Structures and Concrete Bridges

Courses

Title	Typ	Hrs/wk	CP
Design of Prestressed Structures and Concreet Bridges (L0603)	Lecture	3	4
Design of Prestressed Structures and Concreet Bridges (L0604)	Recitation Section (large)	2	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 reached the following learning results
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 Lecture 70
Credit points	6
Course achievement	None
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

Course L0603: Design of Prestressed Structures and Concreet Bridges	
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
Content	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 • 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 • precast bridges - precast segmental bridges • bearings • abutments, columns • construction methods
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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0756: Soil Mechanics and -Dynamics

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Soil Mechanics - Selected Topics (L0374)	Lecture	2	2
Soil Dynamics (L0452)	Lecture	3	2
Experimental Researches in Geotechnics (L0706)	Practical Course	1	2

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	modules: Mathematics I-III, Mechanics I-II, Geotechnics I courses: Soil laboratory course, (Applied structural dynamics)
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After the successful completion of the module the students should be able to: • to derive and to apply the basic equation of a simple mass oscillator, • 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, • to evaluate shocks in term to their effect on people and buildings, • to evaluate possibilities of isolation, • to understand mechanisms that cause earthquakes and evaluate earthquake in term of their magnitude and intensity, • 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, • 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, • to consider the impact of the partly saturated of a seepage and shear strength.
Skills	
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** Yes / 15 % / Subject theoretical and practical work /
Examination	Oral exam
Examination duration and scale	45 min
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

Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Lecture
Hrs/wk	3
CP	2
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42
Lecturer	Alexander Chmelnizkij
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 K.-G.: Bauwerke und Erdbeben. Vieweg Verlag • Studer J.A., Koller M.G. und Laue J.: Bodendynamik, Springer Verlag

Course L0706: Experimental Researches in Geotechnics	
Typ	Practical Course
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. Marius Milatz
Language	DE
Cycle	SoSe
Content	The students are supposed to: • 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.

Module M0807: Boundary Element Methods

Courses

Title	Typ	Hrs/wk	CP
Boundary Element Methods (L0523)	Lecture	2	3
Boundary Element Methods (L0524)	Recitation Section (large)	2	3

Module Responsible	Prof. Otto von Estorff
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	After taking part successfully, students have reached the following learning results
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 to handle engineering problems by formulating suitable boundary elements, assembling the corresponding system matrices, and solving the resulting system of equations.
Personal Competence	
Social Competence	Students can work in small groups on specific problems to arrive at joint solutions.
Autonomy	The students are able to independently solve challenging computational problems and develop own boundary element routines. Problems can be identified and the results are critically scrutinized.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** No / 20 % / Midterm
Examination	Written exam
Examination duration and scale	90 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 Energy Systems: Core Qualification: Elective Compulsory Mechanical Engineering and Management: Specialisation Product Development and 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: Specialisation III. Engineering Science: Elective Compulsory Theoretical Mechanical Engineering: Core Qualification: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0523: Boundary Element Methods	
Typ	Lecture
Hrs/wk	2
CP	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, K.-J. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin

Course L0524: Boundary Element Methods	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Module M0827: Modeling in Water Management

Courses

Title	Typ	Hrs/wk	CP
Applied Groundwater Modeling (L0543)	Lecture	1	1
Applied Groundwater Modeling (L0544)	Recitation Section (small)	2	2
Modeling of Water Supply and Sewer Network (L0875)	Project-/problem-based Learning	2	3

Module Responsible	Dr. Klaus Johannsen
Admission Requirements	None
Recommended Previous Knowledge	Groundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge on urban water infrastructures, in particular drinking water systemsand urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems • Basic knowledge on water management
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 interdependencies of hydraulic and toxic phenomena in soil and water.
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	Wird nicht vermittelt.
Autonomy	Wird nicht vermittelt.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	20 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 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

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0875: Modeling of Water Supply and Sewer Network	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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 M0828: Urban Environmental Management

Courses

Title	Typ	Hrs/wk	CP
Noise Protection (L1109)	Lecture	2	2
Urban Infrastructures (L0874)	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 protection • General knowledge of scientific writing/working
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 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 international 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	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Written Report plus oral 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: Elective Compulsory Environmental Engineering: Core Qualification: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Core Qualification: Compulsory Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise Protection

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Jäschke
Language	EN
Cycle	SoSe
Content	
Literature	1) Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) 2) WHO (1999): Guidelines for Community Noise 3) Environmental Noise Directive 2002/49/EG 4) ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation

Course L0874: Urban Infrastructures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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: Coastal Hydraulic Engineering II

Courses

Title	Typ	Hrs/wk	CP
Coastal- and Flood Protection (L0808)	Lecture	2	3
Coastal- and Flood Protection (L1415)	Project-/problem-based Learning	1	1
Maintennance and Defence of Flood Protection Structures (L1411)	Lecture	2	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	Coastal 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. 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 Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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: Coastal- and Flood Protection

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

Course L1411: Maintennance and Defence of Flood Protection Structures	
Typ	Lecture
Hrs/wk	2
CP	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: Harbour Engineering and Harbour Planning

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Harbour Engineering (L0809)	Lecture	2	2
Harbour Engineering (L1414)	Project-/problem-based Learning	1	2
Port Planning and Port Construction (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 learning results
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 Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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.
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0809: Harbour Engineering

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0378: Port Planning and Port Construction	
Typ	Lecture
Hrs/wk	2
CP	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
Literature	Vorlesungsumdruck, s. www.tu-harburg.de/gbt

Module M0861: Modelling of Hydraulic Engineering

Courses

Title	Typ	Hrs/wk	CP
Hydraulic Models (L0813)	Project-/problem-based Learning	1	1
Modelling of Waves (L0812)	Project-/problem-based Learning	1	1
Modelling of Flow in Rivers 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 learning results
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 gained knowledge in simple applied problems. Additionaly, they will be able to work in team with others.
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
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 3 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: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Course L0813: Hydraulic Models

Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/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
CP	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 • 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: Wastewater Systems

Courses

Title	Typ	Hrs/wk	CP
Wastewater Systems - Collection, Treatment and Reuse (L0934)	Lecture	2	2
Wastewater Systems - Collection, Treatment and Reuse (L0943)	Recitation Section (large)	1	1
Advanced Wastewater Treatment (L0357)	Lecture	2	2
Advanced Wastewater Treatment (L0358)	Recitation Section (large)	1	1

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of wastewater management and the key processes involved in wastewater treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to outline key areas of the full range of treatment systems in waste water management, as well as their mutual dependence for sustainable water protection. They can describe relevant economic, environmental and social factors.
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 Lecture 84
Credit points	6
Course achievement	None
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: Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Process Engineering and Biotechnology: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Wastewater Systems - Collection, Treatment and Reuse	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0357: Advanced Wastewater Treatment	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Survey on advanced wastewater treatment reuse of reclaimed municipal wastewater Precipitation Flocculation Depth filtration 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Aggregate organic compounds (sum parameters) Industrial wastewater Processes for industrial wastewater treatment Precipitation 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 M0922: City Planning

Courses

Title	Typ	Hrs/wk	CP
City Planning (L1066)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Carsten Gertz
Admission Requirements	None
Recommended Previous Knowledge	for "Principles of Urban Planning": none for "Designing Urban Streetscapes": some knowledge of transport planning, e.g. through taking the undergraduate class „Transport Planning and Traffic Engineering“
Educational Objectives	After 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 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	
Social Competence	Students are able to: • 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 pre-defined 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
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment, designwork during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1066: City Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	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: Construction Logistics and Project Management

Courses

Title	Typ	Hrs/wk	CP
Construction Logistics (L1163)	Lecture	1	2
Construction Logistics (L1164)	Recitation Section (small)	1	2
Project Development and Management (L1161)	Lecture	1	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 have reached the following learning results
Professional Competence	
Knowledge	Students can... • 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	Students can... • 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	
Social Competence	Students can... • hold presentations in and for groups • apply methods of conflict solving 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	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Two written papers with presentations
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 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	
Typ	Lecture
Hrs/wk	1
CP	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 • 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 and waste removel logistics) • best practice examples (construction logistics Potsdamer Platz, recent case study of the region) Contents of the lecture are deepened in special exercises.
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: Construction Logistics	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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	
Typ	Lecture
Hrs/wk	1
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	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: Statics and Dynamics of Structures

Courses

Title	Typ	Hrs/wk	CP
Structural Dynamics (L1202)	Lecture	2	2
Structural Dynamics (L1203)	Recitation Section (large)	2	2
Fracture mechanics and fatigue in steel structures (L0564)	Lecture	1	1
Fracture Mechanics and Fatigue (L0565)	Recitation Section (large)	1	1

Module Responsible	Prof. Uwe Starossek
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of linear structural analysis of statically determinate and indeterminate structures; Mechanics I/II, Mathematics I/II, Differential equations I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of this module, the student can explain the basic aspects of dynamic effects on structures and the respective methods.
Skills	After successful completion of this module, the students will be able to predict the response of material and structures to dynamics loading using the appropriate computational approaches and methods.
Personal Competence	
Social Competence	Students can • 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	Students are able to gain knowledge of the subject area from given and other sources and apply it to new problems. Furthermore, they are able to structure the solution process for problems in the area of Structural Analysis.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	150 min
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 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
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L0564: Fracture mechanics and fatigue in steel structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ingo Hadrych
Language	DE
Cycle	SoSe
Content	• 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 accumulation formula 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 in different examples.
Literature	• Seeßelberg, C.; Kranbahnen - Bemessung und konstruktive Gestaltung; 3. Auflage; Bauwerk-Verlag; Berlin 2009 • Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 2003; Verlag Ernst & Sohn; Berlin 2003 • Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Auflage; 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 1-1: Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993 • DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil 6: Kranbahnen; 2001 • DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; Nationales Anwendungsdokument (NAD); Berlin 2002

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

Module M0999: Steel Construction Project

Courses

Title	Typ	Hrs/wk	CP
Steel Construction Project (L1206)	Project Seminar	4	6

Module Responsible	Prof. Marcus Rutner
Admission Requirements	None
Recommended Previous Knowledge	Steel and Composite Structures
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to prepare a part of the whole project and explain it to the others.
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	
Social Competence	Students can present their results to other members of the group. 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 of the project on their own resposibility-
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	approx. 15-20 pages (without 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

Typ	Project Seminar
Hrs/wk	4
CP	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: Marine Geotechnics and Numerics

Courses

Title	Typ	Hrs/wk	CP
Marine Geotechnics (L0548)	Lecture	1	2
Marine Geotechnics (L0549)	Recitation Section (large)	2	1
Numerical Methods in Geotechnics (L0375)	Lecture	3	3

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	complete modules: Geotechnics I-II, Mathematics I-III 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	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following Curricula	Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory Theoretical Mechanical Engineering: Specialisation Maritime Technology: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L0548: Marine Geotechnics

Typ	Lecture
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	• 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

Typ	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0375: Numerical Methods in Geotechnics	
Typ	Lecture
Hrs/wk	3
CP	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 M1133: Port Logistics

Courses

Title	Typ	Hrs/wk	CP
Port Logistics (L0686)	Lecture	2	3
Port Logistics (L1473)	Recitation Section (small)	2	3

Module Responsible	Prof. Carlos Jahn
Admission Requirements	None
Recommended Previous Knowledge	none
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Th After completing the module, students can... • reflect on the development of seaports (in terms of the functions of the ports and the corresponding terminals, as well as the relevant operator models) and place them in their historical context; • explain and evaluate different types of seaport terminals and their specific characteristics (cargo, transhipment technologies, logistic functional areas); • analyze common planning tasks (e.g. berth planning, stowage planning, yard planning) at seaport terminals and develop suitable approaches (in terms of methods and tools) to solve these planning tasks; • identify future developments and trends regarding the planning and control of innovative seaport terminals and discuss them in a problem-oriented manner.
Skills	After completing the module, students will be able to... • recognize functional areas in ports and seaport terminals; • define and evaluate suitable operating systems for container terminals; • perform static calculations with regard to given boundary conditions, e.g. required capacity (parking spaces, equipment requirements, quay wall length, port access) on selected terminal types; • reliably estimate which boundary conditions influence common logistics indicators in the static planning of selected terminal types and to what extent.
Personal Competence	
Social Competence	After completing the module, students can... • transfer the acquired knowledge to further questions of port logistics; • discuss and successfully organize extensive task packages in small groups; • in small groups, document work results in writing in an understandable form and present them to an appropriate extent.
Autonomy	After completing the module, the students are able to... • research and select specialist literature, including standards, guidelines and journal papers, and to develop the contents independently; • submit own parts in an extensive written elaboration in small groups in due time and to present them jointly within a fixed time frame.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** No / 15 % / Written elaboration
Examination	Written exam
Examination duration and scale	120 minutes
Assignment for the Following Curricula	Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective 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 Renewable Energies: Specialisation Wind Energy Systems: Elective Compulsory Naval Architecture and Ocean Engineering: Core Qualification: Elective Compulsory Theoretical Mechanical Engineering: Specialisation Maritime Technology: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0686: Port Logistics	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Carlos Jahn
Language	DE
Cycle	SoSe
Content	Port Logistics deals with the planning, control, execution and monitoring of material flows and the associated information flows in the port system and its interfaces to numerous actors inside and outside the port area. The extraordinary role of maritime transport in international trade requires very efficient ports. These must meet numerous requirements in terms of economy, speed, safety and the environment. Against this background, the lecture Port Logistics deals with the planning, control, execution and monitoring of material flows and the associated information flows in the port system and its interfaces to numerous actors inside and outside the port area. The aim of the lecture Port Logistics is to convey an understanding of structures and processes in ports. The focus will be on different types of terminals, their characteristical layouts and the technical equipment used as well as the ongoing digitization and interaction of the players involved. In addition, renowned guest speakers from science and practice will be regularly invited to discuss some lecture-relevant topics from alternative perspectives. The following contents will be conveyed in the lectures: • Instruction of structures and processes in the port • Planning, control, implementation and monitoring of material and information flows in the port • Fundamentals of different terminals, characteristical layouts and the technical equipment used • Handling of current issues in port logistics
Literature	• Alderton, Patrick (2013). Port Management and Operations. • Biebig, Peter and Althof, Wolfgang and Wagener, Norbert (2017). Seeverkehrswirtschaft: Kompendium. • Brinkmann, Birgitt. Seehäfen: Planung und Entwurf. Berlin Heidelberg: Springer-Verlag, 2005. • Büter, Clemens (2013). Außenhandel: Grundlagen internationaler Handelsbeziehungen. • Gleissner, Harald and Femerling, J. Christian (2012). Logistik: Grundlagen, Übungen, Fallbeispiele. • Jahn, Carlos; Saxe, Sebastian (Hg.). Digitalization of Seaports - Visions of the Future, Stuttgart: Fraunhofer Verlag, 2017. • Kummer, Sebastian (2019). Einführung in die Verkehrswirtschaft • Lun, Y.H.V. and Lai, K.-H. and Cheng, T.C.E. (2010). Shipping and Logistics Management. • Woitschützke, Claus-Peter (2013). Verkehrsgeografie.

Course L1473: Port Logistics	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Carlos Jahn
Language	DE
Cycle	SoSe
Content	The content of the exercise is the independent preparation of a scientific paper plus an accompanying presentation on a current topic of port logistics. The paper deals with current topics of port logistics. For example, the future challenges in sustainability and productivity of ports, the digital transformation of terminals and ports or the introduction of new regulations by the International Maritime Organization regarding the verified gross weight of containers. Due to the international orientation of the event, the paper is to be prepared in English.
Literature	• Alderton, Patrick (2013). Port Management and Operations. • Biebig, Peter and Althof, Wolfgang and Wagener, Norbert (2017). Seeverkehrswirtschaft: Kompendium. • Brinkmann, Birgitt. Seehäfen: Planung und Entwurf. (2005) Berlin Heidelberg: Springer-Verlag. • Büter, Clemens (2013). Außenhandel: Grundlagen internationaler Handelsbeziehungen. • Gleissner, Harald and Femerling, J. Christian (2012). Logistik: Grundlagen, Übungen, Fallbeispiele. • Jahn, Carlos; Saxe, Sebastian (Hg.) (2017) Digitalization of Seaports - Visions of the Future, Stuttgart: Fraunhofer Verlag. • Kummer, Sebastian (2019). Einführung in die Verkehrswirtschaft • Lun, Y.H.V. and Lai, K.-H. and Cheng, T.C.E. (2010). Shipping and Logistics Management. • Woitschützke, Claus-Peter (2013). Verkehrsgeografie.

Module M1132: Maritime Transport

Courses

Title	Typ	Hrs/wk	CP
Maritime Transport (L0063)	Lecture	2	3
Maritime Transport (L0064)	Recitation Section (small)	2	3

Module Responsible	Prof. Carlos Jahn
Admission Requirements	None
Recommended Previous Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students are able to... • present the actors involved in the maritime transport chain with regard to their typical tasks; • name common cargo types in shipping and classify cargo to the corresponding categories; • explain operating forms in maritime shipping, transport options and management in transport networks; • weigh the advantages and disadvantages of the various modes of hinterland transport and apply them in practice; • present relevant factors for the location planning of ports and seaport terminals and discuss them in a problem-oriented way; • estimate the potential of digitisation in maritime shipping.
Skills	The students are able to... • determine the mode of transport, actors and functions of the actors in the maritime supply chain; • identify possible cost drivers in a transport chain and recommend appropriate proposals for cost reduction; • record, map and systematically analyse material and information flows of a maritime logistics chain, identify possible problems and recommend solutions; • perform risk assessments of human disruptions to the supply chain; • analyse accidents in the field of maritime logistics and evaluating their relevance in everyday life; • deal with current research topics in the field of maritime logistics in a differentiated way; • apply different process modelling methods in a hitherto unknown field of activity and to work out the respective advantages.
Personal Competence	
Social Competence	The students are able to... • discuss and organise extensive work packages in groups; • document and present the elaborated results.
Autonomy	The students are capable to... • research and select technical literature, including standards and guidelines; • submit own shares in an extensive written elaboration in small groups in due time.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	**Compulsory**: No; **Bonus**: 15 %; **Form**: Subject theoretical and practical work; **Description**: Teilnahme an einem Planspiel und anschließende schriftliche Ausarbeitung
Examination	Written exam
Examination duration and scale	120 minutes
Assignment for the Following Curricula	Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective 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 Renewable Energies: Specialisation Wind Energy Systems: Elective Compulsory Theoretical Mechanical Engineering: Specialisation Maritime Technology: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0063: Maritime Transport	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Carlos Jahn
Language	DE
Cycle	SoSe
Content	The general tasks of maritime logistics include the planning, design, implementation and control of material and information flows in the logistics chain ship - port - hinterland. This includes technology assessment, selection, dimensioning and implementation as well as the operation of technologies. The aim of the course is to provide students with knowledge of maritime transport and the actors involved in the maritime transport chain. Typical problem areas and tasks will be dealt with, taking into account the economic development. Thus, classical problems as well as current developments and trends in the field of maritime logistics are considered. In the lecture, the components of the maritime logistics chain and the actors involved will be examined and risk assessments of human disturbances on the supply chain will be developed. In addition, students learn to estimate the potential of digitisation in maritime shipping, especially with regard to the monitoring of ships. Further content of the lecture is the different modes of transport in the hinterland, which students can evaluate after completion of the course regarding their advantages and disadvantages.
Literature	• Brinkmann, Birgitt. Seehäfen: Planung und Entwurf. Berlin Heidelberg: Springer-Verlag, 2005. • Schönknecht, Axel. Maritime Containerlogistik: Leistungsvergleich von Containerschiffen in intermodalen Transportketten. Berlin Heidelberg: Springer-Verlag, 2009. • Stopford, Martin. Maritime Economics Routledge, 2009

Course L0064: Maritime Transport	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Carlos Jahn
Language	DE
Cycle	SoSe
Content	The exercise lesson bases on the haptic management game MARITIME. MARITIME focuses on providing knowledge about structures and processes in a maritime transport network. Furthermore, the management game systematically provides process management methodology and also promotes personal skills of the participants.
Literature	• Stopford, Martin. Maritime Economics Routledge, 2009 • Brinkmann, Birgitt. Seehäfen: Planung und Entwurf. Berlin Heidelberg: Springer-Verlag, 2005. • Schönknecht, Axel. Maritime Containerlogistik: Leistungsvergleich von Containerschiffen in intermodalen Transportketten. Berlin Heidelberg: Springer-Verlag, 2009.

Module M1350: Excavation Law and Projects

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Subsoil and Underground Engineering Law (L0395)	Lecture	2	2
Service Contract and Procurement Law (L1906)	Lecture	2	2
Project Geotechnics (L0708)	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	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	15 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: Subsoil and Underground Engineering Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk
Language	DE
Cycle	WiSe
Content	• History of Civil Engineering Law (from 1700 BC to 2000 AD) • Basics of foundation and excarvation law / engineering law (the participants in the case law of geotechnical law case studies) • Legal aspects of technical regulations in civil engineering (with case studies) • The civil engineering contract (including checklists for the special civil engineering contract design and execution) • The liability of the planner and entrepreneur in civil engineering (practical examples, jurisprudence and law, inter alia, to the Ordinance on Combatants, liability for defects and traffic safety obligations, construction law and insurance questions) • The ground / foundation risk and the systemic risk (also in the European context) • The total debt in (low) building law (based on practice-oriented case constellations) • The (construction) conflict, the dispute avoidance models and the construction process (practice-oriented presentation)
Literature	Folienskript (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner-Verlag

Course L1906: Service Contract and Procurement Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk, Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	
Literature	

Course L0708: Project Geotechnics	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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 M0581: Water Protection

Courses

Title	Typ	Hrs/wk	CP
Water Protection and Wastewater Management (L0226)	Lecture	3	3
Water Protection and Wastewater Management (L2008)	Project Seminar	3	3

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	• Basic knowledge in water management; • Good knowledge in urban drainage; • Good knowledge of wastewater treatment techniques; • Good knowledge of pollutants (e.g. COD, BOD, TS, N, P) and their properties;
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	The students can work together in international groups.
Autonomy	Students are able to organize their work flow to prepare presentations and discussions. They can acquire appropriate knowledge by making enquiries independently.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Presentation
Examination duration and scale	Term paper plus 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: 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 Water and Environmental Engineering: Specialisation Environment: Compulsory

Course L0226: Water Protection and Wastewater Management	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	The lecture focusses on: • 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	
Typ	Project Seminar
Hrs/wk	3
CP	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: Examination of Materials, Structural Condition and Damages

Courses

Title	Typ	Hrs/wk	CP
Examination of Materials, Structural Condition and Damages (L0260)	Lecture	3	4
Examination of Materials, Structural Condition and Damages (L0261)	Recitation Section (small)	1	2

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge about building materials or material science, for example by the module 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 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, 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 make the timing and the operation steps to learn the specialist knowledge of a very extensive field.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 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

Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
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

Typ	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0619: Waste Treatment Technologies

Courses

Title	Typ	Hrs/wk	CP
Waste and Environmental Chemistry (L0328)	Practical Course	2	2
Biological Waste Treatment (L0318)	Project-/problem-based Learning	3	4

Module Responsible	Prof. Kerstin Kuchta
Admission Requirements	None
Recommended Previous Knowledge	chemical and biological basics
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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 Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
Examination	Presentation
Examination duration and scale	Elaboration and Presentation (15-25 minutes in groups)
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

Course L0328: Waste and Environmental Chemistry	
Typ	Practical Course
Hrs/wk	2
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	1. Introduction 2. biological basics 3. determination process specific material characterization 4. aerobic degradation (Composting, stabilization) 5. anaerobic degradation (Biogas production, fermentation) 6. Technical layout and process design 7. Flue gas treatment 8. Plant design practical phase
Literature	

Module M0705: Groundwater

Courses

Title	Typ	Hrs/wk	CP
Geohydraulic and Solute Transport (L0539)	Lecture	2	2
Geohydraulic and Solute Transport (L0540)	Recitation Section (small)	1	1
Simulation in Groundwater Hydrology (L0541)	Lecture	1	1
Simulation in Groundwater Hydrology (L0542)	Recitation Section (small)	2	2

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	• Ground water hydrology • Hydromechanics
Educational Objectives	After taking part successfully, students have reached the following learning 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 Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 min written exam and written papers
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 Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process 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 L0539: Geohydraulic and Solute Transport

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0541: Simulation in Groundwater Hydrology	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0713: Concrete Structures

Courses

Title	Typ	Hrs/wk	CP
Concrete Structures (L0579)	Seminar	1	1
Structural Concrete Members (L0577)	Lecture	2	3
Structural Concrete Members (L0578)	Recitation Section (large)	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basics of structural analysis, conception and dimensioning of structural concrete Modules: Reinforced Concrete Structures I+II, Structural Analysis I+II, Mechanics I+II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Presentation; **Description** Es werden 2 Referate ausgegeben
Examination	Written exam
Examination duration and scale	120 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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L0579: Concrete Structures

Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Björn Schütte
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	• 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 können im STUDiP heruntergeladen werden • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Ingenieurbau. Springer, Heidelberg 2010 • König, G., Liphardt S.: Hochhäuser aus Stahlbeton, Betonkalender 2003, Teil II, Seite 1-69, Verlag Ernst & Sohn, Berlin 2003 • Phocas, Marios C.: Hochhäuser : Tragwerk und Konstruktion, Stuttgart, Teubner, 2005 • Deutscher Ausschuss für Stahlbeton: Heft 600: Erläuterungen zu DIN EN 1992-1-1, Beuth Verlag, Berlin 2012 • Deutscher Ausschuss für Stahlbeton: Heft 240: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken, Verlag Ernst & Sohn, Berlin 1978 • Stiglat, K., Wippel, H.: Massive Platten - Ausgewählte Kapitel der Schnittkraftermittlung und Bemessung, Betonkalender 1992, Teil I, 287-366, Verlag Ernst & Sohn, Berlin 1992 • Stiglat/Wippel: Platten. Verlag Ernst & Sohn, Berlin,1973 • Schlaich J.; Schäfer K.: Konstruieren im Stahlbetonbau. Betonkalender 1998, Teil II, S. 721ff, Verlag Ernst & Sohn, Berlin, 1998 • Dames K.-H.: Rohbauzeichnungen Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997

Course L0578: Structural Concrete Members	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Björn Schütte
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0722: Computational Analysis of Concrete Structures

Courses

Title	Typ	Hrs/wk	CP
Computational Analysis of Concrete Structures (L0598)	Lecture	2	3
Computational Analysis of Concrete Structures (L0599)	Recitation Section (large)	1	1
FE-Modeling of Concrete Structures (L0600)	Project-/problem-based Learning	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge in structural analysis and design of reinforced concrete structures (beams, slabs, shear walls). Lectures 'Concrete Structures I und II' Lectures 'Structural Analysis I and II' 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 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** Yes / None / Excercises / Es ist ein Tragsystem mit TEDDY zu modellieren Yes / None / Attestation / Am Ende des Semster ist ein Tragsystem mit dem Rechenprogramm zu modellieren
Examination	Oral exam
Examination duration and scale	45 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

Course L0598: Computational Analysis of Concrete Structures

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	• 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0600: FE-Modeling of Concrete Structures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. 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. C1.-C.36)

Module M0923: Integrated Transportation Planning

Courses

Title	Typ	Hrs/wk	CP
Integrated Transportation Planning (L1068)	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 Engineerin
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to: • describe interdependencies between land-use/location choice and 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 an opinion on them.
Skills	Students are able to: • 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 scientific conventions.
Personal Competence	
Social Competence	Students are able to: • 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, acquire the necessary knowledge and use appropriate means for its execution.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment with presentation during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1068: Integrated Transportation Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß
Language	DE
Cycle	WiSe
Content	The course will provide students with an understanding of interdependencies between land-use 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: Steel and Composite Structures

Courses

Title	Typ	Hrs/wk	CP
Steel and Composite Structures (L1204)	Lecture	2	2
Steel and Composite Structures (L1205)	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 Structures I and II, BUBC)
Educational Objectives	After taking part successfully, students have reached the following learning 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 sttructures • 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	--
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	180 min
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L1204: Steel and Composite Structures

Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L1097: Steel Bridges	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Jörg Ahlgrimm
Language	DE
Cycle	WiSe
Content	**Lecture Contents ‚Steel Bridge Construction'** **Dr.-Ing. 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) - 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 über die Fulda, Stahlbau 74 (2005), Heft 2, S. 114

Module M0967: Study Work Harbour and Coastal Engineering

Courses			
Title	**Typ**	**Hrs/wk**	**CP**

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
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	
Knowledge	The students are able to demonstrate their detailed knowledge in the field of port and coastal 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. 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 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
Course achievement	None
Examination	Study work
Examination duration and scale	The number of pages depends on the task.
Assignment for the Following Curricula	Civil Engineering: Specialisation Coastal Engineering: Compulsory

Module M0969: Selected Topics in Civil Engineering

Courses

Title	Typ	Hrs/wk	CP
Analysis of Offshore Structures (L1867)	Lecture	1	1
Excellence in International Project Delivery (L2387)	Integrated Lecture	2	2
Design of Prefabricated Concrete Structures (L0596)	Lecture	1	1
Design of Prefabricated Concrete Structures (L0597)	Recitation Section (large)	1	1
Forum I - Geotechnics and Construction Management (L1634)	Seminar	1	1
Forum II - Geotechnics and Construction Management (L1635)	Seminar	1	1
Geotechnical Engineering Design (L2447)	Lecture	2	3
Timber Structures (L1151)	Seminar	2	2
Glass Structures (L1152)	Lecture	2	2
Glass Structures (L1447)	Recitation Section (large)	1	1
Special topics of civil engineering 1CP (L2378)		1	1
Special topics of civil engineering 2 LP (L2379)		2	2
Special topics of civil engineering 3 LP (L2380)		3	3
Wind turbine design (L1905)	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 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 of 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, in which fields they want to deepen their knowledge and skills through the election of courses.
Workload in Hours	Depends on choice of courses
Credit points	6
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

Course L1867: Analysis of Offshore Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Mündliche Prüfung
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	Chakrabarti, Handbook of Offshore Engineering, 2005 Sarpkaya, Wave Forces on Offshore Structures, 2010 Faltinsen, Sea Loads on Ships and Offshore Structures, 1998 Sorensen, Basic Coastal Engineering, 2006 Dowling, Mechanical Behavior of Materials, 2007 Haibach, Betriebsfestigkeit, 2006 Marshall, Design of Welded Tubular Connections, 1992 Newland, Random vibrations, spectral and wavelet analysis, 1993

Course L2387: Excellence in International Project Delivery	
Typ	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jens Huckfeldt
Language	EN
Cycle	SoSe
Content	
Literature	

Course L0596: Design of Prefabricated Concrete Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
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 K.-H.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 Teil 2, S. 241-296 • Graubner C.-A. 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
CP	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	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1634: Forum I - Geotechnics and Construction Management	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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 L2447: Geotechnical Engineering Design	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	45 Min.
Lecturer	Prof. Jürgen Grabe, Dr. Tim Pucker
Language	DE
Cycle	WiSe
Content	The focus of the course is on the design of geotechnical structures. Methods and fundamental approaches for the successful processing of geotechnical designs are taught. Theoretical approaches are backed up with examples from everyday work in industry. In parallel to the theoretical content, students are given a practical task for a geotechnical design at beginning of the course, which will be worked on in small teams. In addition to the application of the already acquired technical knowledge, topics like realisation, construction sequence planning, cost calculation, optimisation and evaluation criteria are also part of the course. The event will be finished with the presentation of the designs.
Literature	

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

Course L1152: Glass Structures	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	
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	

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

Course L2378: Special topics of civil engineering 1CP	
Typ	
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2379: Special topics of civil engineering 2 LP	
Typ	
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jan Mittelstädt, Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2380: Special topics of civil engineering 3 LP	
Typ	
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

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

Module M0997: Structural Analysis - Selected Topics

Courses

Title	Typ	Hrs/wk	CP
Plates and Shells (L1199)	Lecture	2	2
Nonlinear Analysis of Frame Structure (L1200)	Lecture	2	2
Nonlinear Analysis of Frame Structure (L1201)	Recitation Section (large)	2	2

Module Responsible	Prof. Uwe Starossek
Admission Requirements	None
Recommended Previous Knowledge	Mechanics I/II, Mathematics I/II, Differential Equations I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of this module, students can explain selected elements of higher structural analysis.
Skills	After successful completion of this module, the students are able to assess the premises and the applicability of the presented methods of advanced structural analysis. They are able to use these methods for performing structural analyses.
Personal Competence	
Social Competence	Students can • 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 voluntarily and independently work homework problems.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	135 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

Course L1199: Plates and Shells	
Typ	Lecture
Hrs/wk	2
CP	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, unveränderter Nachdruck 1986 • Zienkiewicz, O.C. (1977): The Finite Element Method in Enginieering Science. McGraw-Hill, London

Course L1200: Nonlinear Analysis of Frame Structure	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Module M0801: Water Resources and -Supply

Courses

Title	Typ	Hrs/wk	CP
Chemistry of Drinking Water Treatment (L0311)	Lecture	2	1
Chemistry of Drinking Water Treatment (L0312)	Recitation Section (large)	1	2
Water Resource Management (L0402)	Lecture	2	2
Water Resource Management (L0403)	Recitation Section (small)	1	1

Module Responsible	Prof. Mathias Ernst
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of water management and the key processes involved in water treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
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
Course achievement	None
Examination	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 Water and Traffic: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective 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	
Typ	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen
Language	DE
Cycle	WiSe
Content	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). 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.
Literature	**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. **Jensen, J. N.**: A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.

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

Course L0402: Water Resource Management	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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 M1505: Adaptation to Climate Change in Hydraulic Engineering (AKWAS)

Courses

Title	Typ	Hrs/wk	CP
Adaptation to climate change in hydraulic engineering (L2291)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	• Hydrology, Hydraulic Engineering • Hydromechanic, Hydraulics • Fundamentals of Coastal Engineering, Coastal- and Flood Protection • Hydrological Systems
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	• Climate protection and climate adaptation • Insights into climate change and its regional characteristics - fundamentals, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle • Fundamentals of analysis of climate data • Consequences of the impact of the climate change • Measures for climate adaptation • Assessment, prioritization and communication of adaptation measures • Fundamentals of the analysis of hydrometeorological and hydrological data
Skills	• Critical thinking: analysis of processes and relations, assessment of needs for action • Creative thinking: development of adaptation strategies and adaptation measures • Practical thinking: inclusion of restrictions, application of calculation approaches, methods, numerical models, planning methods • Consideration of complex tasks
Personal Competence	
Social Competence	• Working in heterogenous groups • Working with different scientific / non-scientific disciplines • Self reflection
Autonomy	• Application oriented use of knowledge and skills • Autonomous work on complex tasks
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Preparation of a written report and a presentation of a complex task.
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 Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L2291: Adaptation to climate change in hydraulic engineering	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	• Climate protection and climate adaptation • Findings on climate change and its regional characteristics: fundamentals of climate change, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle(climate science view) • Fundamentals of the analysis of climate data • Concequences of the impacts of climate change (ingenieering science view) • Measures for climate change adaptation • Assessment, prioritization and communication of measures • Fundamentals of analysis of hydrometeorological and hydrological data
Literature	• Bereitgestellte eLearning Plattform

Specialization Geotechnical Engineering

Module M0699: Advanced Foundation Engineering and Soil Laboratory Course

Courses

Title	Typ	Hrs/wk	CP
Soil Laboratory Course (L0499)	Practical Course	1	2
Numerical Methods in Geotechnics (L0375)	Lecture	3	3
Advanced Foundation Engineering (L0497)	Lecture	2	2
Advanced Foundation Engineering (L0498)	Recitation Section (large)	1	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 82, Study Time in Lecture 98
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
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

Typ	Practical Course
Hrs/wk	1
CP	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 L0375: Numerical Methods in Geotechnics	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Hans Mathäus Stanford
Language	DE
Cycle	WiSe
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

Course L0497: Advanced Foundation Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0858: Coastal Hydraulic Engineering I

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Basics of Coastal Engineering (L0807)	Lecture	3	4
Basics of Coastal Engineering (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 reached the following learning results
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 Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.
Assignment for the Following 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

Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	• Basics of planning and design ∘ Water levels ∘ Currents ∘ Waves ∘ Ice • Planning and Design in Coastal Engineering ∘ Functional and constructional design ∘ Determination of design parameters ∘ Design-approaches ▪ Filter ▪ Rubble mound constructions ▪ Piles ▪ Vertical constructions
Literature	Coastal Engineering Manual, CEM Vorlesungsumdruck

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

Module M0964: Structures in Foundation and Hydraulic Engineering

Courses

Title	Typ	Hrs/wk	CP
Applied Tunnel Constructions (L2407)	Lecture	2	3
Steel Structures in Foundation and Hydraulic Engineering (L1146)	Lecture	2	3
Underground Constructions (L0707)	Lecture	1	2
Underground Constructions (L1811)	Recitation Section (large)	1	1

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	Modules from Bachelor studies Civil and environmental engineering: • Geotechnics I-II • Steel Structures I-II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	Capacity for teamwork concerning project management and design of tunnels.
Autonomy	Promotion of independent and creative work flow in the framework of a design exercise.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 minutes
Assignment for the Following Curricula	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

Course L2407: Applied Tunnel Constructions

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe, Tim Babendererde
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1146: Steel Structures in Foundation and Hydraulic Engineering

Typ	Lecture
Hrs/wk	2
CP	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: Underground Constructions	
Typ	Lecture
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Marius Milatz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0511: Electricity Generation from Wind and Hydro Power

Courses

Title	Typ	Hrs/wk	CP
Renewable Energy Projects in Emerged Markets (L0014)	Project Seminar	1	1
Hydro Power Use (L0013)	Lecture	1	1
Wind Turbine Plants (L0011)	Lecture	2	3
Wind Energy Use - Focus Offshore (L0012)	Lecture	1	1

Module Responsible	Dr. Joachim Gerth
Admission Requirements	None
Recommended Previous Knowledge	Module: Technical Thermodynamics I, Module: Technical Thermodynamics II, Module: Fundamentals of Fluid Mechanics
Educational Objectives	After taking part successfully, students have reached the following learning results
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, students improve their understanding and the application of the theoretical background and are thus able to transfer what they have learned in practice.
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 multidisciplinary within 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
Course achievement	None
Examination	Written exam
Examination duration and scale	3 hours written exam
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 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: Elective Compulsory 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	
Typ	Project Seminar
Hrs/wk	1
CP	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 ∘ 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.
Literature	Folien der Vorlesung

Course L0013: Hydro Power Use	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Achleitner
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Rudolf Zellermann, Dr. Jochen Oexmann
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	
Typ	Lecture
Hrs/wk	1
CP	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: Construction Processes

Courses

Title	Typ	Hrs/wk	CP
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 successfully, students have reached the following learning results
Professional Competence	
Knowledge	
Skills	
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 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 L1908: Digital Building

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Markus Salge
Language	DE
Cycle	SoSe
Content	
Literature	

Module M0593: Building Materials and Building Preservation

Courses

Title	Typ	Hrs/wk	CP
Repair of Structures (L0255)	Lecture	1	1
Mineral Building Materials (L0253)	Lecture	2	2
Technology of mineral Building Materials (L0256)	Project-/problem-based Learning	1	2
Transport Processes in Building Materials and Damage Processes (L0254)	Lecture	1	1

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	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 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 present 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** 20 %; **Form** Subject theoretical and practical work; **Description**
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 L0255: Repair of Structures

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Design and production of a special mineral building material
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis

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

Module M0723: Design of Prestressed Structures and Concrete Bridges

Courses

Title	Typ	Hrs/wk	CP
Design of Prestressed Structures and Concreet Bridges (L0603)	Lecture	3	4
Design of Prestressed Structures and Concreet Bridges (L0604)	Recitation Section (large)	2	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 reached the following learning results
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 Lecture 70
Credit points	6
Course achievement	None
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

Course L0603: Design of Prestressed Structures and Concreet Bridges	
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
Content	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 • 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 • precast bridges - precast segmental bridges • bearings • abutments, columns • construction methods
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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0756: Soil Mechanics and -Dynamics

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Soil Mechanics - Selected Topics (L0374)	Lecture	2	2
Soil Dynamics (L0452)	Lecture	3	2
Experimental Researches in Geotechnics (L0706)	Practical Course	1	2

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	modules: Mathematics I-III, Mechanics I-II, Geotechnics I courses: Soil laboratory course, (Applied structural dynamics)
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After the successful completion of the module the students should be able to: • to derive and to apply the basic equation of a simple mass oscillator, • 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, • to evaluate shocks in term to their effect on people and buildings, • to evaluate possibilities of isolation, • to understand mechanisms that cause earthquakes and evaluate earthquake in term of their magnitude and intensity, • 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, • 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, • to consider the impact of the partly saturated of a seepage and shear strength.
Skills	
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** Yes / 15 % / Subject theoretical and practical work /
Examination	Oral exam
Examination duration and scale	45 min
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

Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Lecture
Hrs/wk	3
CP	2
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42
Lecturer	Alexander Chmelnizkij
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 K.-G.: Bauwerke und Erdbeben. Vieweg Verlag • Studer J.A., Koller M.G. und Laue J.: Bodendynamik, Springer Verlag

Course L0706: Experimental Researches in Geotechnics	
Typ	Practical Course
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. Marius Milatz
Language	DE
Cycle	SoSe
Content	The students are supposed to: • 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.

Module M0807: Boundary Element Methods

Courses

Title	Typ	Hrs/wk	CP
Boundary Element Methods (L0523)	Lecture	2	3
Boundary Element Methods (L0524)	Recitation Section (large)	2	3

Module Responsible	Prof. Otto von Estorff
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	After taking part successfully, students have reached the following learning results
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 to handle engineering problems by formulating suitable boundary elements, assembling the corresponding system matrices, and solving the resulting system of equations.
Personal Competence	
Social Competence	Students can work in small groups on specific problems to arrive at joint solutions.
Autonomy	The students are able to independently solve challenging computational problems and develop own boundary element routines. Problems can be identified and the results are critically scrutinized.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	**Compulsory** No · **Bonus** 20 % · **Form** Midterm · **Description**
Examination	Written exam
Examination duration and scale	90 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 Energy Systems: Core Qualification: Elective Compulsory Mechanical Engineering and Management: Specialisation Product Development and 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: Specialisation III. Engineering Science: Elective Compulsory Theoretical Mechanical Engineering: Core Qualification: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0523: Boundary Element Methods	
Typ	Lecture
Hrs/wk	2
CP	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, K.-J. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin

Course L0524: Boundary Element Methods	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Module M0827: Modeling in Water Management

Courses

Title	Typ	Hrs/wk	CP
Applied Groundwater Modeling (L0543)	Lecture	1	1
Applied Groundwater Modeling (L0544)	Recitation Section (small)	2	2
Modeling of Water Supply and Sewer Network (L0875)	Project-/problem-based Learning	2	3

Module Responsible	Dr. Klaus Johannsen
Admission Requirements	None
Recommended Previous Knowledge	Groundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge on urban water infrastructures, in particular drinking water systemsand urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems • Basic knowledge on water management
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 interdependencies of hydraulic and toxic phenomena in soil and water.
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	Wird nicht vermittelt.
Autonomy	Wird nicht vermittelt.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	20 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 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

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0875: Modeling of Water Supply and Sewer Network	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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 M0828: Urban Environmental Management

Courses

Title	Typ	Hrs/wk	CP
Noise Protection (L1109)	Lecture	2	2
Urban Infrastructures (L0874)	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 protection • General knowledge of scientific writing/working
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 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 international 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	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Written Report plus oral 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: Elective Compulsory Environmental Engineering: Core Qualification: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Core Qualification: Compulsory Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise Protection

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Jäschke
Language	EN
Cycle	SoSe
Content	
Literature	1) Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) 2) WHO (1999): Guidelines for Community Noise 3) Environmental Noise Directive 2002/49/EG 4) ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation

Course L0874: Urban Infrastructures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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: Coastal Hydraulic Engineering II

Courses

Title	Typ	Hrs/wk	CP
Coastal- and Flood Protection (L0808)	Lecture	2	3
Coastal- and Flood Protection (L1415)	Project-/problem-based Learning	1	1
Maintennance and Defence of Flood Protection Structures (L1411)	Lecture	2	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	Coastal 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. 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 Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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: Coastal- and Flood Protection

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

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

Course L1411: Maintennance and Defence of Flood Protection Structures	
Typ	Lecture
Hrs/wk	2
CP	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: Harbour Engineering and Harbour Planning

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Harbour Engineering (L0809)	Lecture	2	2
Harbour Engineering (L1414)	Project-/problem-based Learning	1	2
Port Planning and Port Construction (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 learning results
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 Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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.
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0809: Harbour Engineering

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0378: Port Planning and Port Construction	
Typ	Lecture
Hrs/wk	2
CP	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
Literature	Vorlesungsumdruck, s. www.tu-harburg.de/gbt

Module M0861: Modelling of Hydraulic Engineering

Courses

Title	Typ	Hrs/wk	CP
Hydraulic Models (L0813)	Project-/problem-based Learning	1	1
Modelling of Waves (L0812)	Project-/problem-based Learning	1	1
Modelling of Flow in Rivers 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 learning results
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 gained knowledge in simple applied problems. Additionaly, they will be able to work in team with others.
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
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 3 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: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Course L0813: Hydraulic Models

Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/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
CP	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 • 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: Wastewater Systems

Courses

Title	Typ	Hrs/wk	CP
Wastewater Systems - Collection, Treatment and Reuse (L0934)	Lecture	2	2
Wastewater Systems - Collection, Treatment and Reuse (L0943)	Recitation Section (large)	1	1
Advanced Wastewater Treatment (L0357)	Lecture	2	2
Advanced Wastewater Treatment (L0358)	Recitation Section (large)	1	1

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of wastewater management and the key processes involved in wastewater treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to outline key areas of the full range of treatment systems in waste water management, as well as their mutual dependence for sustainable water protection. They can describe relevant economic, environmental and social factors.
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 Lecture 84
Credit points	6
Course achievement	None
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: Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Process Engineering and Biotechnology: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Wastewater Systems - Collection, Treatment and Reuse	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0357: Advanced Wastewater Treatment	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Survey on advanced wastewater treatment reuse of reclaimed municipal wastewater Precipitation Flocculation Depth filtration 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Aggregate organic compounds (sum parameters) Industrial wastewater Processes for industrial wastewater treatment Precipitation 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 M0922: City Planning

Courses

Title	Typ	Hrs/wk	CP
City Planning (L1066)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Carsten Gertz
Admission Requirements	None
Recommended Previous Knowledge	for "Principles of Urban Planning": none for "Designing Urban Streetscapes": some knowledge of transport planning, e.g. through taking the undergraduate class „Transport Planning and Traffic Engineering“
Educational Objectives	After 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 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	
Social Competence	Students are able to: • 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 pre-defined 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
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment, designwork during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1066: City Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	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: Construction Logistics and Project Management

Courses

Title	Typ	Hrs/wk	CP
Construction Logistics (L1163)	Lecture	1	2
Construction Logistics (L1164)	Recitation Section (small)	1	2
Project Development and Management (L1161)	Lecture	1	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 have reached the following learning results
Professional Competence	
Knowledge	Students can... • 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	Students can... • 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	
Social Competence	Students can... • hold presentations in and for groups • apply methods of conflict solving 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	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Two written papers with presentations
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 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	
Typ	Lecture
Hrs/wk	1
CP	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 • 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 and waste removel logistics) • best practice examples (construction logistics Potsdamer Platz, recent case study of the region) Contents of the lecture are deepened in special exercises.
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: Construction Logistics	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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	
Typ	Lecture
Hrs/wk	1
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	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: Statics and Dynamics of Structures

Courses

Title	Typ	Hrs/wk	CP
Structural Dynamics (L1202)	Lecture	2	2
Structural Dynamics (L1203)	Recitation Section (large)	2	2
Fracture mechanics and fatigue in steel structures (L0564)	Lecture	1	1
Fracture Mechanics and Fatigue (L0565)	Recitation Section (large)	1	1

Module Responsible	Prof. Uwe Starossek
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of linear structural analysis of statically determinate and indeterminate structures; Mechanics I/II, Mathematics I/II, Differential equations I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of this module, the student can explain the basic aspects of dynamic effects on structures and the respective methods.
Skills	After successful completion of this module, the students will be able to predict the response of material and structures to dynamics loading using the appropriate computational approaches and methods.
Personal Competence	
Social Competence	Students can • 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	Students are able to gain knowledge of the subject area from given and other sources and apply it to new problems. Furthermore, they are able to structure the solution process for problems in the area of Structural Analysis.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	150 min
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 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
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L0564: Fracture mechanics and fatigue in steel structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ingo Hadrych
Language	DE
Cycle	SoSe
Content	• 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 accumulation formula 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 in different examples.
Literature	• Seeßelberg, C.; Kranbahnen - Bemessung und konstruktive Gestaltung; 3. Auflage; Bauwerk-Verlag; Berlin 2009 • Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 2003; Verlag Ernst & Sohn; Berlin 2003 • Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Auflage; 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 1-1: Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993 • DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil 6: Kranbahnen; 2001 • DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; Nationales Anwendungsdokument (NAD); Berlin 2002

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

Module M0999: Steel Construction Project

Courses

Title	Typ	Hrs/wk	CP
Steel Construction Project (L1206)	Project Seminar	4	6

Module Responsible	Prof. Marcus Rutner
Admission Requirements	None
Recommended Previous Knowledge	Steel and Composite Structures
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to prepare a part of the whole project and explain it to the others.
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	
Social Competence	Students can present their results to other members of the group. 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 of the project on their own resposibility-
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	approx. 15-20 pages (without 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

Typ	Project Seminar
Hrs/wk	4
CP	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: Marine Geotechnics and Numerics

Courses

Title	Typ	Hrs/wk	CP
Marine Geotechnics (L0548)	Lecture	1	2
Marine Geotechnics (L0549)	Recitation Section (large)	2	1
Numerical Methods in Geotechnics (L0375)	Lecture	3	3

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	complete modules: Geotechnics I-II, Mathematics I-III 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	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following Curricula	Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory Theoretical Mechanical Engineering: Specialisation Maritime Technology: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L0548: Marine Geotechnics

Typ	Lecture
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	• 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

Typ	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0375: Numerical Methods in Geotechnics	
Typ	Lecture
Hrs/wk	3
CP	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 M1350: Excavation Law and Projects

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Subsoil and Underground Engineering Law (L0395)	Lecture	2	2
Service Contract and Procurement Law (L1906)	Lecture	2	2
Project Geotechnics (L0708)	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	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	15 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: Subsoil and Underground Engineering Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk
Language	DE
Cycle	WiSe
Content	• History of Civil Engineering Law (from 1700 BC to 2000 AD) • Basics of foundation and excavation law / engineering law (the participants in the case law of geotechnical law case studies) • Legal aspects of technical regulations in civil engineering (with case studies) • The civil engineering contract (including checklists for the special civil engineering contract design and execution) • The liability of the planner and entrepreneur in civil engineering (practical examples, jurisprudence and law, inter alia, to the Ordinance on Combatants, liability for defects and traffic safety obligations, construction law and insurance questions) • The ground / foundation risk and the systemic risk (also in the European context) • The total debt in (low) building law (based on practice-oriented case constellations) • The (construction) conflict, the dispute avoidance models and the construction process (practice-oriented presentation)
Literature	Folienskript (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner-Verlag

Course L1906: Service Contract and Procurement Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk, Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	
Literature	

Course L0708: Project Geotechnics	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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 M0581: Water Protection

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Water Protection and Wastewater Management (L0226)	Lecture	3	3
Water Protection and Wastewater Management (L2008)	Project Seminar	3	3

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	• Basic knowledge in water management; • Good knowledge in urban drainage; • Good knowledge of wastewater treatment techniques; • Good knowledge of pollutants (e.g. COD, BOD, TS, N, P) and their properties;
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	The students can work together in international groups.
Autonomy	Students are able to organize their work flow to prepare presentations and discussions. They can acquire appropriate knowledge by making enquiries independently.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Presentation
Examination duration and scale	Term paper plus 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: 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 Water and Environmental Engineering: Specialisation Environment: Compulsory

Course L0226: Water Protection and Wastewater Management	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	The lecture focusses on: • 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	
Typ	Project Seminar
Hrs/wk	3
CP	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: Examination of Materials, Structural Condition and Damages

Courses

Title	Typ	Hrs/wk	CP
Examination of Materials, Structural Condition and Damages (L0260)	Lecture	3	4
Examination of Materials, Structural Condition and Damages (L0261)	Recitation Section (small)	1	2

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge about building materials or material science, for example by the module 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 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, 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 make the timing and the operation steps to learn the specialist knowledge of a very extensive field.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 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

Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
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

Typ	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0619: Waste Treatment Technologies

Courses

Title	Typ	Hrs/wk	CP
Waste and Environmental Chemistry (L0328)	Practical Course	2	2
Biological Waste Treatment (L0318)	Project-/problem-based Learning	3	4

Module Responsible	Prof. Kerstin Kuchta
Admission Requirements	None
Recommended Previous Knowledge	chemical and biological basics
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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 Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
Examination	Presentation
Examination duration and scale	Elaboration and Presentation (15-25 minutes in groups)
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

Course L0328: Waste and Environmental Chemistry	
Typ	Practical Course
Hrs/wk	2
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	1. Introduction 2. biological basics 3. determination process specific material characterization 4. aerobic degradation (Composting, stabilization) 5. anaerobic degradation (Biogas production, fermentation) 6. Technical layout and process design 7. Flue gas treatment 8. Plant design practical phase
Literature	

Module M0705: Groundwater

Courses

Title	Typ	Hrs/wk	CP
Geohydraulic and Solute Transport (L0539)	Lecture	2	2
Geohydraulic and Solute Transport (L0540)	Recitation Section (small)	1	1
Simulation in Groundwater Hydrology (L0541)	Lecture	1	1
Simulation in Groundwater Hydrology (L0542)	Recitation Section (small)	2	2

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	• Ground water hydrology • Hydromechanics
Educational Objectives	After taking part successfully, students have reached the following learning 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 Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 min written exam and written papers
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 Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process 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 L0539: Geohydraulic and Solute Transport

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0541: Simulation in Groundwater Hydrology	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0713: Concrete Structures

Courses

Title	Typ	Hrs/wk	CP
Concrete Structures (L0579)	Seminar	1	1
Structural Concrete Members (L0577)	Lecture	2	3
Structural Concrete Members (L0578)	Recitation Section (large)	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basics of structural analysis, conception and dimensioning of structural concrete Modules: Reinforced Concrete Structures I+II, Structural Analysis I+II, Mechanics I+II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory**: Yes; **Bonus**: None; **Form**: Presentation; **Description**: Es werden 2 Referate ausgegeben
Examination	Written exam
Examination duration and scale	120 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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L0579: Concrete Structures

Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Björn Schütte
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	• 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 können im STUDiP heruntergeladen werden • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Ingenieurbau. Springer, Heidelberg 2010 • König, G., Liphardt S.: Hochhäuser aus Stahlbeton, Betonkalender 2003, Teil II, Seite 1-69, Verlag Ernst & Sohn, Berlin 2003 • Phocas, Marios C.: Hochhäuser : Tragwerk und Konstruktion, Stuttgart, Teubner, 2005 • Deutscher Ausschuss für Stahlbeton: Heft 600: Erläuterungen zu DIN EN 1992-1-1, Beuth Verlag, Berlin 2012 • Deutscher Ausschuss für Stahlbeton: Heft 240: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken, Verlag Ernst & Sohn, Berlin 1978 • Stiglat, K., Wippel, H.: Massive Platten - Ausgewählte Kapitel der Schnittkraftermittlung und Bemessung, Betonkalender 1992, Teil I, 287-366, Verlag Ernst & Sohn, Berlin 1992 • Stiglat/Wippel: Platten. Verlag Ernst & Sohn, Berlin,1973 • Schlaich J.; Schäfer K.: Konstruieren im Stahlbetonbau. Betonkalender 1998, Teil II, S. 721ff, Verlag Ernst & Sohn, Berlin, 1998 • Dames K.-H.: Rohbauzeichnungen Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997

Course L0578: Structural Concrete Members	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Björn Schütte
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0722: Computational Analysis of Concrete Structures

Courses

Title	Typ	Hrs/wk	CP
Computational Analysis of Concrete Structures (L0598)	Lecture	2	3
Computational Analysis of Concrete Structures (L0599)	Recitation Section (large)	1	1
FE-Modeling of Concrete Structures (L0600)	Project-/problem-based Learning	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge in structural analysis and design of reinforced concrete structures (beams, slabs, shear walls). Lectures 'Concrete Structures I und II' Lectures 'Structural Analysis I and II' 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 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	see below
Examination	Oral exam
Examination duration and scale	45 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

Course achievement

Compulsory	Bonus	Form	Description
Yes	None	Attestation	Am Ende des Semster ist ein Tragsystem mit dem Rechenprogramm zu modellieren
Yes	None	Excercises	Es ist ein Tragsystem mit TEDDY zu modellieren

Course L0598: Computational Analysis of Concrete Structures

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe

Content

- 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0600: FE-Modeling of Concrete Structures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. 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. C1.-C.36)

Module M0801: Water Resources and -Supply

Courses

Title	Typ	Hrs/wk	CP
Chemistry of Drinking Water Treatment (L0311)	Lecture	2	1
Chemistry of Drinking Water Treatment (L0312)	Recitation Section (large)	1	2
Water Resource Management (L0402)	Lecture	2	2
Water Resource Management (L0403)	Recitation Section (small)	1	1

Module Responsible	Prof. Mathias Ernst
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of water management and the key processes involved in water treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
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
Course achievement	None
Examination	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 Water and Traffic: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective 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	
Typ	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen
Language	DE
Cycle	WiSe
Content	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). 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.
Literature	**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. **Jensen, J. N.**: A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.

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

Course L0402: Water Resource Management	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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 M0923: Integrated Transportation Planning

Courses

Title	Typ	Hrs/wk	CP
Integrated Transportation Planning (L1068)	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 Engineerin
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to: • describe interdependencies between land-use/location choice and 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 an opinion on them.
Skills	Students are able to: • 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 scientific conventions.
Personal Competence	
Social Competence	Students are able to: • 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, acquire the necessary knowledge and use appropriate means for its execution.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment with presentation during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1068: Integrated Transportation Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß
Language	DE
Cycle	WiSe
Content	The course will provide students with an understanding of interdependencies between land-use 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: Steel and Composite Structures

Courses

Title	Typ	Hrs/wk	CP
Steel and Composite Structures (L1204)	Lecture	2	2
Steel and Composite Structures (L1205)	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 Structures I and II, BUBC)
Educational Objectives	After taking part successfully, students have reached the following learning 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 sttructures • 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	--
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	180 min
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L1204: Steel and Composite Structures

Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L1097: Steel Bridges	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Jörg Ahlgrimm
Language	DE
Cycle	WiSe
Content	**Lecture Contents ‚Steel Bridge Construction'** **Dr.-Ing. 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) - 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 über die Fulda, Stahlbau 74 (2005), Heft 2, S. 114

Module M0966: Study Work Foundation Engineering

Courses			
Title	**Typ**	**Hrs/wk**	**CP**

Module Responsible	Dozenten des SD B
Admission Requirements	None
Recommended Previous Knowledge	Subjects of the Foundation Engineering 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 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. 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 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 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
Course achievement	None
Examination	Study work
Examination duration and scale	see FSPO
Assignment for the Following Curricula	Civil Engineering: Specialisation Geotechnical Engineering: Compulsory

Module M0969: Selected Topics in Civil Engineering

Courses

Title	Typ	Hrs/wk	CP
Analysis of Offshore Structures (L1867)	Lecture	1	1
Excellence in International Project Delivery (L2387)	Integrated Lecture	2	2
Design of Prefabricated Concrete Structures (L0596)	Lecture	1	1
Design of Prefabricated Concrete Structures (L0597)	Recitation Section (large)	1	1
Forum I - Geotechnics and Construction Management (L1634)	Seminar	1	1
Forum II - Geotechnics and Construction Management (L1635)	Seminar	1	1
Geotechnical Engineering Design (L2447)	Lecture	2	3
Timber Structures (L1151)	Seminar	2	2
Glass Structures (L1152)	Lecture	2	2
Glass Structures (L1447)	Recitation Section (large)	1	1
Special topics of civil engineering 1CP (L2378)		1	1
Special topics of civil engineering 2 LP (L2379)		2	2
Special topics of civil engineering 3 LP (L2380)		3	3
Wind turbine design (L1905)	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 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 of 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, in which fields they want to deepen their knowledge and skills through the election of courses.
Workload in Hours	Depends on choice of courses
Credit points	6
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

Course L1867: Analysis of Offshore Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Mündliche Prüfung
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	Chakrabarti, Handbook of Offshore Engineering, 2005 Sarpkaya, Wave Forces on Offshore Structures, 2010 Faltinsen, Sea Loads on Ships and Offshore Structures, 1998 Sorensen, Basic Coastal Engineering, 2006 Dowling, Mechanical Behavior of Materials, 2007 Haibach, Betriebsfestigkeit, 2006 Marshall, Design of Welded Tubular Connections, 1992 Newland, Random vibrations, spectral and wavelet analysis, 1993

Course L2387: Excellence in International Project Delivery	
Typ	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jens Huckfeldt
Language	EN
Cycle	SoSe
Content	
Literature	

Course L0596: Design of Prefabricated Concrete Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
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 K.-H.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 Teil 2, S. 241-296 • Graubner C.-A. 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
CP	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	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1634: Forum I - Geotechnics and Construction Management	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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 L2447: Geotechnical Engineering Design	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	45 Min.
Lecturer	Prof. Jürgen Grabe, Dr. Tim Pucker
Language	DE
Cycle	WiSe
Content	The focus of the course is on the design of geotechnical structures. Methods and fundamental approaches for the successful processing of geotechnical designs are taught. Theoretical approaches are backed up with examples from everyday work in industry. In parallel to the theoretical content, students are given a practical task for a geotechnical design at beginning of the course, which will be worked on in small teams. In addition to the application of the already acquired technical knowledge, topics like realisation, construction sequence planning, cost calculation, optimisation and evaluation criteria are also part of the course. The event will be finished with the presentation of the designs.
Literature	

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

Course L1152: Glass Structures	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	
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	

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

Course L2378: Special topics of civil engineering 1CP	
Typ	
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2379: Special topics of civil engineering 2 LP	
Typ	
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jan Mittelstädt, Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2380: Special topics of civil engineering 3 LP	
Typ	
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

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

Module M0997: Structural Analysis - Selected Topics

Courses

Title	Typ	Hrs/wk	CP
Plates and Shells (L1199)	Lecture	2	2
Nonlinear Analysis of Frame Structure (L1200)	Lecture	2	2
Nonlinear Analysis of Frame Structure (L1201)	Recitation Section (large)	2	2

Module Responsible	Prof. Uwe Starossek
Admission Requirements	None
Recommended Previous Knowledge	Mechanics I/II, Mathematics I/II, Differential Equations I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of this module, students can explain selected elements of higher structural analysis.
Skills	After successful completion of this module, the students are able to assess the premises and the applicability of the presented methods of advanced structural analysis. They are able to use these methods for performing structural analyses.
Personal Competence	
Social Competence	Students can • 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 voluntarily and independently work homework problems.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	135 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

Course L1199: Plates and Shells	
Typ	Lecture
Hrs/wk	2
CP	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, unveränderter Nachdruck 1986 • Zienkiewicz, O.C. (1977): The Finite Element Method in Enginieering Science. McGraw-Hill, London

Course L1200: Nonlinear Analysis of Frame Structure	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Module M1505: Adaptation to Climate Change in Hydraulic Engineering (AKWAS)

Courses

Title	Typ	Hrs/wk	CP
Adaptation to climate change in hydraulic engineering (L2291)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	• Hydrology, Hydraulic Engineering • Hydromechanic, Hydraulics • Fundamentals of Coastal Engineering, Coastal- and Flood Protection • Hydrological Systems
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	• Climate protection and climate adaptation • Insights into climate change and its regional characteristics - fundamentals, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle • Fundamentals of analysis of climate data • Consequences of the impact of the climate change • Measures for climate adaptation • Assessment, prioritization and communication of adaptation measures • Fundamentals of the analysis of hydrometeorological and hydrological data
Skills	• Critical thinking: analysis of processes and relations, assessment of needs for action • Creative thinking: development of adaptation strategies and adaptation measures • Practical thinking: inclusion of restrictions, application of calculation approaches, methods, numerical models, planning methods • Consideration of complex tasks
Personal Competence	
Social Competence	• Working in heterogenous groups • Working with different scientific / non-scientific disciplines • Self reflection
Autonomy	• Application oriented use of knowledge and skills • Autonomous work on complex tasks
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Preparation of a written report and a presentation of a complex task.
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 Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L2291: Adaptation to climate change in hydraulic engineering	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	• Climate protection and climate adaptation • Findings on climate change and its regional characteristics: fundamentals of climate change, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle(climate science view) • Fundamentals of the analysis of climate data • Concequences of the impacts of climate change (ingenieering science view) • Measures for climate change adaptation • Assessment, prioritization and communication of measures • Fundamentals of analysis of hydrometeorological and hydrological data
Literature	• Bereitgestellte eLearning Plattform

Specialization Structural Engineering

Module M0699: Advanced Foundation Engineering and Soil Laboratory Course

Courses

Title	Typ	Hrs/wk	CP
Soil Laboratory Course (L0499)	Practical Course	1	2
Numerical Methods in Geotechnics (L0375)	Lecture	3	3
Advanced Foundation Engineering (L0497)	Lecture	2	2
Advanced Foundation Engineering (L0498)	Recitation Section (large)	1	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 82, Study Time in Lecture 98
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
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

Typ	Practical Course
Hrs/wk	1
CP	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 L0375: Numerical Methods in Geotechnics	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Hans Mathäus Stanford
Language	DE
Cycle	WiSe
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

Course L0497: Advanced Foundation Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0713: Concrete Structures

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Concrete Structures (L0579)	Seminar	1	1
Structural Concrete Members (L0577)	Lecture	2	3
Structural Concrete Members (L0578)	Recitation Section (large)	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basics of structural analysis, conception and dimensioning of structural concrete Modules 'Concrete Structures I and II'
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** Yes / None / Presentation / Es werden 2 Referate ausgegeben
Examination	Written exam
Examination duration and scale	120 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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L0579: Concrete Structures

Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Björn Schütte
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	• 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 können im STUDiP heruntergeladen werden • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Ingenieurbau. Springer, Heidelberg 2010 • König, G., Liphardt S.: Hochhäuser aus Stahlbeton, Betonkalender 2003, Teil II, Seite 1-69, Verlag Ernst & Sohn, Berlin 2003 • Phocas, Marios C.: Hochhäuser : Tragwerk und Konstruktion, Stuttgart, Teubner, 2005 • Deutscher Ausschuss für Stahlbeton: Heft 600: Erläuterungen zu DIN EN 1992-1-1, Beuth Verlag, Berlin 2012 • Deutscher Ausschuss für Stahlbeton: Heft 240: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken, Verlag Ernst & Sohn, Berlin 1978 • Stiglat, K., Wippel, H.: Massive Platten - Ausgewählte Kapitel der Schnittkraftermittlung und Bemessung, Betonkalender 1992, Teil I, 287-366, Verlag Ernst & Sohn, Berlin 1992 • Stiglat/Wippel: Platten. Verlag Ernst & Sohn, Berlin,1973 • Schlaich J.; Schäfer K.: Konstruieren im Stahlbetonbau. Betonkalender 1998, Teil II, S. 721ff, Verlag Ernst & Sohn, Berlin, 1998 • Dames K.-H.: Rohbauzeichnungen Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997

Course L0578: Structural Concrete Members	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Björn Schütte
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0963: Steel and Composite Structures

Courses

Title	Typ	Hrs/wk	CP
Steel and Composite Structures (L1204)	Lecture	2	2
Steel and Composite Structures (L1205)	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 Structures I and II, BUBC)
Educational Objectives	After taking part successfully, students have reached the following learning 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 sttructures • 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	--
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	180 min
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L1204: Steel and Composite Structures

Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L1097: Steel Bridges	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Jörg Ahlgrimm
Language	DE
Cycle	WiSe
Content	**Lecture Contents ‚Steel Bridge Construction'** **Dr.-Ing. 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) - 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 über die Fulda, Stahlbau 74 (2005), Heft 2, S. 114

Module M0511: Electricity Generation from Wind and Hydro Power

Courses

Title	Typ	Hrs/wk	CP
Renewable Energy Projects in Emerged Markets (L0014)	Project Seminar	1	1
Hydro Power Use (L0013)	Lecture	1	1
Wind Turbine Plants (L0011)	Lecture	2	3
Wind Energy Use - Focus Offshore (L0012)	Lecture	1	1

Module Responsible	Dr. Joachim Gerth
Admission Requirements	None
Recommended Previous Knowledge	Module: Technical Thermodynamics I, Module: Technical Thermodynamics II, Module: Fundamentals of Fluid Mechanics
Educational Objectives	After taking part successfully, students have reached the following learning results
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, students improve their understanding and the application of the theoretical background and are thus able to transfer what they have learned in practice.
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 multidisciplinary within 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
Course achievement	None
Examination	Written exam
Examination duration and scale	3 hours written exam
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 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: Elective Compulsory 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	
Typ	Project Seminar
Hrs/wk	1
CP	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
	  ◦ 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.

Literature	Folien der Vorlesung

Course L0013: Hydro Power Use	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Achleitner
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Rudolf Zellermann, Dr. Jochen Oexmann
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	
Typ	Lecture
Hrs/wk	1
CP	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: Construction Processes

Courses

Title	Typ	Hrs/wk	CP
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 successfully, students have reached the following learning results
Professional Competence	
Knowledge	
Skills	
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 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 L1908: Digital Building

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Markus Salge
Language	DE
Cycle	SoSe
Content	
Literature	

Module M0723: Design of Prestressed Structures and Concrete Bridges

Courses

Title	Typ	Hrs/wk	CP
Design of Prestressed Structures and Concreet Bridges (L0603)	Lecture	3	4
Design of Prestressed Structures and Concreet Bridges (L0604)	Recitation Section (large)	2	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 reached the following learning results
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 Lecture 70
Credit points	6
Course achievement	None
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

Course L0603: Design of Prestressed Structures and Concreet Bridges	
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
Content	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 • 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 • precast bridges - precast segmental bridges • bearings • abutments, columns • construction methods
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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0807: Boundary Element Methods

Courses

Title	Typ	Hrs/wk	CP
Boundary Element Methods (L0523)	Lecture	2	3
Boundary Element Methods (L0524)	Recitation Section (large)	2	3

Module Responsible	Prof. Otto von Estorff
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	After taking part successfully, students have reached the following learning results
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 to handle engineering problems by formulating suitable boundary elements, assembling the corresponding system matrices, and solving the resulting system of equations.
Personal Competence	
Social Competence	Students can work in small groups on specific problems to arrive at joint solutions.
Autonomy	The students are able to independently solve challenging computational problems and develop own boundary element routines. Problems can be identified and the results are critically scrutinized.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	**Compulsory** No, **Bonus** 20 %, **Form** Midterm, **Description**
Examination	Written exam
Examination duration and scale	90 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 Energy Systems: Core Qualification: Elective Compulsory Mechanical Engineering and Management: Specialisation Product Development and 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: Specialisation III. Engineering Science: Elective Compulsory Theoretical Mechanical Engineering: Core Qualification: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0523: Boundary Element Methods	
Typ	Lecture
Hrs/wk	2
CP	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, K.-J. (2000): Finite-Elemente-Methoden. Springer Verlag, Berlin

Course L0524: Boundary Element Methods	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Module M0756: Soil Mechanics and -Dynamics

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Soil Mechanics - Selected Topics (L0374)	Lecture	2	2
Soil Dynamics (L0452)	Lecture	3	2
Experimental Researches in Geotechnics (L0706)	Practical Course	1	2

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	modules: Mathematics I-III, Mechanics I-II, Geotechnics I courses: Soil laboratory course, (Applied structural dynamics)
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After the successful completion of the module the students should be able to: • to derive and to apply the basic equation of a simple mass oscillator, • 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, • to evaluate shocks in term to their effect on people and buildings, • to evaluate possibilities of isolation, • to understand mechanisms that cause earthquakes and evaluate earthquake in term of their magnitude and intensity, • 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, • 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, • to consider the impact of the partly saturated of a seepage and shear strength.
Skills	
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** 15 %; **Form** Subject theoretical and practical work; **Description**
Examination	Oral exam
Examination duration and scale	45 min
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

Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Lecture
Hrs/wk	3
CP	2
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42
Lecturer	Alexander Chmelnizkij
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 K.-G.: Bauwerke und Erdbeben. Vieweg Verlag • Studer J.A., Koller M.G. und Laue J.: Bodendynamik, Springer Verlag

Course L0706: Experimental Researches in Geotechnics	
Typ	Practical Course
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. Marius Milatz
Language	DE
Cycle	SoSe
Content	The students are supposed to: • 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.

Module M0827: Modeling in Water Management

Courses

Title	Typ	Hrs/wk	CP
Applied Groundwater Modeling (L0543)	Lecture	1	1
Applied Groundwater Modeling (L0544)	Recitation Section (small)	2	2
Modeling of Water Supply and Sewer Network (L0875)	Project-/problem-based Learning	2	3

Module Responsible	Dr. Klaus Johannsen
Admission Requirements	None
Recommended Previous Knowledge	Groundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge on urban water infrastructures, in particular drinking water systemsand urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems • Basic knowledge on water management
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 interdependencies of hydraulic and toxic phenomena in soil and water.
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	Wird nicht vermittelt.
Autonomy	Wird nicht vermittelt.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	20 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 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

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0875: Modeling of Water Supply and Sewer Network	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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 M0828: Urban Environmental Management

Courses

Title	Typ	Hrs/wk	CP
Noise Protection (L1109)	Lecture	2	2
Urban Infrastructures (L0874)	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 protection • General knowledge of scientific writing/working
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 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 international 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	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Written Report plus oral 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: Elective Compulsory Environmental Engineering: Core Qualification: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Core Qualification: Compulsory Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise Protection

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Jäschke
Language	EN
Cycle	SoSe
Content	
Literature	1) Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) 2) WHO (1999): Guidelines for Community Noise 3) Environmental Noise Directive 2002/49/EG 4) ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation

Course L0874: Urban Infrastructures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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: Coastal Hydraulic Engineering II

Courses

Title	Typ	Hrs/wk	CP
Coastal- and Flood Protection (L0808)	Lecture	2	3
Coastal- and Flood Protection (L1415)	Project-/problem-based Learning	1	1
Maintennance and Defence of Flood Protection Structures (L1411)	Lecture	2	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	Coastal 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. 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 Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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: Coastal- and Flood Protection

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

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

Course L1411: Maintennance and Defence of Flood Protection Structures	
Typ	Lecture
Hrs/wk	2
CP	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: Harbour Engineering and Harbour Planning

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Harbour Engineering (L0809)	Lecture	2	2
Harbour Engineering (L1414)	Project-/problem-based Learning	1	2
Port Planning and Port Construction (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 learning results
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 Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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.
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0809: Harbour Engineering

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0378: Port Planning and Port Construction	
Typ	Lecture
Hrs/wk	2
CP	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
Literature	Vorlesungsumdruck, s. www.tu-harburg.de/gbt

Module M0861: Modelling of Hydraulic Engineering

Courses

Title	Typ	Hrs/wk	CP
Hydraulic Models (L0813)	Project-/problem-based Learning	1	1
Modelling of Waves (L0812)	Project-/problem-based Learning	1	1
Modelling of Flow in Rivers 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 learning results
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 gained knowledge in simple applied problems. Additionaly, they will be able to work in team with others.
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
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 3 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: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective Compulsory

Course L0813: Hydraulic Models

Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/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
CP	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 • 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: Wastewater Systems

Courses

Title	Typ	Hrs/wk	CP
Wastewater Systems - Collection, Treatment and Reuse (L0934)	Lecture	2	2
Wastewater Systems - Collection, Treatment and Reuse (L0943)	Recitation Section (large)	1	1
Advanced Wastewater Treatment (L0357)	Lecture	2	2
Advanced Wastewater Treatment (L0358)	Recitation Section (large)	1	1

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of wastewater management and the key processes involved in wastewater treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to outline key areas of the full range of treatment systems in waste water management, as well as their mutual dependence for sustainable water protection. They can describe relevant economic, environmental and social factors.
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 Lecture 84
Credit points	6
Course achievement	None
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: Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Process Engineering and Biotechnology: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Wastewater Systems - Collection, Treatment and Reuse	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0357: Advanced Wastewater Treatment	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Survey on advanced wastewater treatment reuse of reclaimed municipal wastewater Precipitation Flocculation Depth filtration 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Aggregate organic compounds (sum parameters) Industrial wastewater Processes for industrial wastewater treatment Precipitation 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 M0922: City Planning

Courses

Title	Typ	Hrs/wk	CP
City Planning (L1066)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Carsten Gertz
Admission Requirements	None
Recommended Previous Knowledge	for "Principles of Urban Planning": none for "Designing Urban Streetscapes": some knowledge of transport planning, e.g. through taking the undergraduate class „Transport Planning and Traffic Engineering“
Educational Objectives	After 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 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	
Social Competence	Students are able to: • 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 pre-defined 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
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment, designwork during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1066: City Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	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: Construction Logistics and Project Management

Courses

Title	Typ	Hrs/wk	CP
Construction Logistics (L1163)	Lecture	1	2
Construction Logistics (L1164)	Recitation Section (small)	1	2
Project Development and Management (L1161)	Lecture	1	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 have reached the following learning results
Professional Competence	
Knowledge	Students can... • 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	Students can... • 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	
Social Competence	Students can... • hold presentations in and for groups • apply methods of conflict solving 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	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Two written papers with presentations
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 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	
Typ	Lecture
Hrs/wk	1
CP	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 • 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 and waste removel logistics) • best practice examples (construction logistics Potsdamer Platz, recent case study of the region) Contents of the lecture are deepened in special exercises.
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: Construction Logistics	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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	
Typ	Lecture
Hrs/wk	1
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	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: Statics and Dynamics of Structures

Courses

Title	Typ	Hrs/wk	CP
Structural Dynamics (L1202)	Lecture	2	2
Structural Dynamics (L1203)	Recitation Section (large)	2	2
Fracture mechanics and fatigue in steel structures (L0564)	Lecture	1	1
Fracture Mechanics and Fatigue (L0565)	Recitation Section (large)	1	1

Module Responsible	Prof. Uwe Starossek
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of linear structural analysis of statically determinate and indeterminate structures; Mechanics I/II, Mathematics I/II, Differential equations I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of this module, the student can explain the basic aspects of dynamic effects on structures and the respective methods.
Skills	After successful completion of this module, the students will be able to predict the response of material and structures to dynamics loading using the appropriate computational approaches and methods.
Personal Competence	
Social Competence	Students can • 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	Students are able to gain knowledge of the subject area from given and other sources and apply it to new problems. Furthermore, they are able to structure the solution process for problems in the area of Structural Analysis.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	150 min
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 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
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L0564: Fracture mechanics and fatigue in steel structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ingo Hadrych
Language	DE
Cycle	SoSe
Content	• 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 accumulation formula 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 in different examples.
Literature	• Seeßelberg, C.; Kranbahnen - Bemessung und konstruktive Gestaltung; 3. Auflage; Bauwerk-Verlag; Berlin 2009 • Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 2003; Verlag Ernst & Sohn; Berlin 2003 • Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Auflage; 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 1-1: Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993 • DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil 6: Kranbahnen; 2001 • DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; Nationales Anwendungsdokument (NAD); Berlin 2002

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

Module M0593: Building Materials and Building Preservation

Courses

Title	Typ	Hrs/wk	CP
Repair of Structures (L0255)	Lecture	1	1
Mineral Building Materials (L0253)	Lecture	2	2
Technology of mineral Building Materials (L0256)	Project-/problem-based Learning	1	2
Transport Processes in Building Materials and Damage Processes (L0254)	Lecture	1	1

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	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 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 present 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes · **Bonus** 20 % · **Form** Subject theoretical and practical work · **Description**
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 L0255: Repair of Structures

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Design and production of a special mineral building material
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis

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

Module M0999: Steel Construction Project

Courses

Title	Typ	Hrs/wk	CP
Steel Construction Project (L1206)	Project Seminar	4	6

Module Responsible	Prof. Marcus Rutner
Admission Requirements	None
Recommended Previous Knowledge	Steel and Composite Structures
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to prepare a part of the whole project and explain it to the others.
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	
Social Competence	Students can present their results to other members of the group. 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 of the project on their own resposibility-
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	approx. 15-20 pages (without 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

Typ	Project Seminar
Hrs/wk	4
CP	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: Marine Geotechnics and Numerics

Courses

Title	Typ	Hrs/wk	CP
Marine Geotechnics (L0548)	Lecture	1	2
Marine Geotechnics (L0549)	Recitation Section (large)	2	1
Numerical Methods in Geotechnics (L0375)	Lecture	3	3

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	complete modules: Geotechnics I-II, Mathematics I-III 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	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following Curricula	Civil Engineering: Specialisation Geotechnical Engineering: Compulsory Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Civil Engineering: Specialisation Coastal Engineering: Compulsory Theoretical Mechanical Engineering: Specialisation Maritime Technology: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L0548: Marine Geotechnics

Typ	Lecture
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	• 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

Typ	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0375: Numerical Methods in Geotechnics	
Typ	Lecture
Hrs/wk	3
CP	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 M1350: Excavation Law and Projects

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Subsoil and Underground Engineering Law (L0395)	Lecture	2	2
Service Contract and Procurement Law (L1906)	Lecture	2	2
Project Geotechnics (L0708)	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	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	15 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: Subsoil and Underground Engineering Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk
Language	DE
Cycle	WiSe
Content	• History of Civil Engineering Law (from 1700 BC to 2000 AD) • Basics of foundation and excarvation law / engineering law (the participants in the case law of geotechnical law case studies) • Legal aspects of technical regulations in civil engineering (with case studies) • The civil engineering contract (including checklists for the special civil engineering contract design and execution) • The liability of the planner and entrepreneur in civil engineering (practical examples, jurisprudence and law, inter alia, to the Ordinance on Combatants, liability for defects and traffic safety obligations, construction law and insurance questions) • The ground / foundation risk and the systemic risk (also in the European context) • The total debt in (low) building law (based on practice-oriented case constellations) • The (construction) conflict, the dispute avoidance models and the construction process (practice-oriented presentation)
Literature	Folienskript (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner-Verlag

Course L1906: Service Contract and Procurement Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk, Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	
Literature	

Course L0708: Project Geotechnics	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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 M1345: Metallic and Hybrid Light-weight Materials

Courses

Title	Typ	Hrs/wk	CP
Joining of Polymer-Metal Lightweight Structures (L0500)	Lecture	2	2
Joining of Polymer-Metal Lightweight Structures (L0501)	Practical Course	1	1
Metallic Light-weight Materials (L1660)	Lecture	2	3

Module Responsible	Prof. Marcus Rutner
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 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	45 min
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Elective Compulsory Materials Science: Specialisation Engineering Materials: Elective Compulsory

Course L0500: Joining of Polymer-Metal Lightweight Structures

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	EN
Cycle	WiSe

Content

Contents:

The lecture and the related laboratory exercises intend to provide an insight on advanced joining technologies for polymer-metal lightweight structures used in engineering applications. A general understanding of the principles of the consolidated and new technologies and its main fields of applications is to be accomplished through theoretical and practical lectures.

Theoretical Lectures:

- Review of the relevant properties of Lightweight Alloys, Engineering Plastics and Composites in Joining Technology
- Introduction to Welding of Lightweight Alloys, Thermoplastics and Fiber Reinforced Plastics
- Mechanical Fastening of Polymer-Metal Hybrid Structures
- Adhesive Bonding of Polymer-Metal Hybrid Structures
- Fusion and Solid State Joining Processes of Polymer-Metal Hybrid Structures
- Hybrid Joining Methods and Direct Assembly of Polymer-Metal Hybrid Structures

Laboratory Exercises:

- Joining Processes: Introduction to state-of-the-art joining technologies
- Introduction to metallographic specimen preparation, optical microscopy and mechanical testing of polymer-metal joints

Course Outcomes:

After successful completion of this unit, students should be able to understand the principles of welding and joining of polymer-metal lightweight structures as well as their application fields.

Literature

- S. T. Amancio-Filho, L.-A. Blaga, Joining of Polymer-Metal Hybrid Structures, Wiley, 2018
- J.F. Shackelford, Introduction to materials science for engineers, Prentice-Hall International
- J. Rotheiser, Joining of Plastics, Handbook for designers and engineers, Hanser Publishers
- D.A. Grewell, A. Benatar, J.B. Park, Plastics and Composites Welding Handbook
- D. Lohwasser, Z. Chen, Friction Stir Welding, From basics to applications, Woodhead Publishing Limited
- J. Friedrich, Metal-Polymer Systems: Interface Design and Chemical Bonding, Wiley, 2017

Course L0501: Joining of Polymer-Metal Lightweight Structures	
Typ	Practical Course
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Marcus Rutner
Language	EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1660: Metallic Light-weight Materials	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Domonkos Tolnai
Language	DE
Cycle	WiSe
Content	Lightweight construction - Structural lightweight construction - Material lightweight construction - Choice criteria for metallic lightweight construction materials Steel as lightweight construction materials - Introduction to the fundamentals of steels - Modern steels for the lightweight construction - Fine grain steels - High-strength low-alloyed steels - Multi-phase steels (dual phase, TRIP) - Weldability - Applications Aluminium alloys: Introduction to the fundamentals of aluminium materials Alloy systems Non age-hardenable Al alloys: Processing and microstructure, mechanical qualities and applications Age-hardenable Al alloys: Processing and microstructure, mechanical qualities and applications Magnesium alloys Introduction to the fundamental of magnesium materials Alloy systems Magnesium casting alloys, processing, microstructure and qualities Magnesium wrought alloys, processing, microstructure and qualities Examples of applications Titanium alloys Introduction to the fundamental of the titanium materials Alloy systems Processing, microstructure and properties Examples of applications

	Exercises and excursions
Literature	George Krauss, Steels: Processing, Structure, and Performance, 978-0-87170-817-5, 2006, 613 S. Hans Berns, Werner Theisen, Ferrous Materials: Steel and Cast Iron, 2008. http://dx.doi.org/10.1007/978-3-540-71848-2 C. W. Wegst, Stahlschlüssel = Key to steel = La Clé des aciers = Chiave dell'acciaio = Liave del acero ISBN/ISSN: 3922599095 Bruno C., De Cooman / John G. Speer: Fundamentals of Steel Product Physical Metallurgy, 2011, 642 S. Harry Chandler, Steel Metallurgy for the Non-Metallurgist 0-87170-652-0, 2006, 84 S. Catrin Kammer, Aluminium Taschenbuch 1, Grundlagen und Werkstoffe, Beuth, 16. Auflage 2009. 784 S., ISBN 978-3-410-22028-2 Günter Drossel, Susanne Friedrich, Catrin Kammer und Wolfgang Lehnert, Aluminium Taschenbuch 2, Umformung von Aluminium-Werkstoffen, Gießen von Aluminiumteilen, Oberflächenbehandlung von Aluminium, Recycling und Ökologie, Beuth, 16. Auflage 2009. 768 S., ISBN 978-3-410-22029-9 Catrin Kammer, Aluminium Taschenbuch 3, Weiterverarbeitung und Anwendung, Beuith,17. Auflage 2014. 892 S., ISBN 978-3-410-22311-5 G. Lütjering, J.C. Williams: Titanium, 2nd ed., Springer, Berlin, Heidelberg, 2007, ISBN 978-3-540-71397 Magnesium - Alloys and Technologies, K. U. Kainer (Hrsg.), Wiley-VCH, Weinheim 2003, ISBN 3-527-30570-x Mihriban O. Pekguleryuz, Karl U. Kainer and Ali Kaya “Fundamentals of Magnesium Alloy Metallurgy”, Woodhead Publishing Ltd, 2013,ISBN 10: 0857090887

Module M0581: Water Protection

Courses

Title	Typ	Hrs/wk	CP
Water Protection and Wastewater Management (L0226)	Lecture	3	3
Water Protection and Wastewater Management (L2008)	Project Seminar	3	3

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	• Basic knowledge in water management; • Good knowledge in urban drainage; • Good knowledge of wastewater treatment techniques; • Good knowledge of pollutants (e.g. COD, BOD, TS, N, P) and their properties;
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	The students can work together in international groups.
Autonomy	Students are able to organize their work flow to prepare presentations and discussions. They can acquire appropriate knowledge by making enquiries independently.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Presentation
Examination duration and scale	Term paper plus 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: 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 Water and Environmental Engineering: Specialisation Environment: Compulsory

Course L0226: Water Protection and Wastewater Management	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	The lecture focusses on: • 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	
Typ	Project Seminar
Hrs/wk	3
CP	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: Examination of Materials, Structural Condition and Damages

Courses

Title	Typ	Hrs/wk	CP
Examination of Materials, Structural Condition and Damages (L0260)	Lecture	3	4
Examination of Materials, Structural Condition and Damages (L0261)	Recitation Section (small)	1	2

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge about building materials or material science, for example by the module 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 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, 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 make the timing and the operation steps to learn the specialist knowledge of a very extensive field.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 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

Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
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

Typ	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0603: Nonlinear Structural Analysis

Courses

Title	Typ	Hrs/wk	CP
Nonlinear Structural Analysis (L0277)	Lecture	3	4
Nonlinear Structural Analysis (L0279)	Recitation Section (small)	1	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 + solve problems in heterogeneous groups and to document the corresponding results. + share new knowledge with group members.
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
Course achievement	None
Examination	Written exam
Examination duration and scale	120 min
Assignment for the Following Curricula	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: Technical Complementary Course: Elective Compulsory Theoretical Mechanical Engineering: Core Qualification: Elective Compulsory Theoretical Mechanical Engineering: Specialisation Simulation Technology: Elective Compulsory

Course L0277: Nonlinear Structural Analysis	
Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Alexander Düster
Language	DE/EN
Cycle	WiSe
Content	1. Introduction 2. Nonlinear phenomena 3. Mathematical preliminaries 4. Basic equations of continuum mechanics 5. Spatial discretization with finite elements 6. Solution of nonlinear systems of equations 7. Solution of elastoplastic problems 8. Stability problems 9. 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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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 M0619: Waste Treatment Technologies

Courses

Title	Typ	Hrs/wk	CP
Waste and Environmental Chemistry (L0328)	Practical Course	2	2
Biological Waste Treatment (L0318)	Project-/problem-based Learning	3	4

Module Responsible	Prof. Kerstin Kuchta
Admission Requirements	None
Recommended Previous Knowledge	chemical and biological basics
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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 Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
Examination	Presentation
Examination duration and scale	Elaboration and Presentation (15-25 minutes in groups)
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

Course L0328: Waste and Environmental Chemistry	
Typ	Practical Course
Hrs/wk	2
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	1. Introduction 2. biological basics 3. determination process specific material characterization 4. aerobic degradation (Composting, stabilization) 5. anaerobic degradation (Biogas production, fermentation) 6. Technical layout and process design 7. Flue gas treatment 8. Plant design practical phase
Literature	

Module M0705: Groundwater

Courses

Title	Typ	Hrs/wk	CP
Geohydraulic and Solute Transport (L0539)	Lecture	2	2
Geohydraulic and Solute Transport (L0540)	Recitation Section (small)	1	1
Simulation in Groundwater Hydrology (L0541)	Lecture	1	1
Simulation in Groundwater Hydrology (L0542)	Recitation Section (small)	2	2

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	• Ground water hydrology • Hydromechanics
Educational Objectives	After taking part successfully, students have reached the following learning 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 Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 min written exam and written papers
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 Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process 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 L0539: Geohydraulic and Solute Transport

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0541: Simulation in Groundwater Hydrology	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0722: Computational Analysis of Concrete Structures

Courses

Title	Typ	Hrs/wk	CP
Computational Analysis of Concrete Structures (L0598)	Lecture	2	3
Computational Analysis of Concrete Structures (L0599)	Recitation Section (large)	1	1
FE-Modeling of Concrete Structures (L0600)	Project-/problem-based Learning	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge in structural analysis and design of reinforced concrete structures (beams, slabs, shear walls). Lectures 'Concrete Structures I und II' Lectures 'Structural Analysis I and II' 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 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** Yes / None / Attestation / Am Ende des Semster ist ein Tragsystem mit dem Rechenprogramm zu modellieren Yes / None / Excercises / Es ist ein Tragsystem mit TEDDY zu modellieren
Examination	Oral exam
Examination duration and scale	45 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

Course L0598: Computational Analysis of Concrete Structures

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	• 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0600: FE-Modeling of Concrete Structures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. 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. C1.-C.36)

Module M0801: Water Resources and -Supply

Courses

Title	Typ	Hrs/wk	CP
Chemistry of Drinking Water Treatment (L0311)	Lecture	2	1
Chemistry of Drinking Water Treatment (L0312)	Recitation Section (large)	1	2
Water Resource Management (L0402)	Lecture	2	2
Water Resource Management (L0403)	Recitation Section (small)	1	1

Module Responsible	Prof. Mathias Ernst
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of water management and the key processes involved in water treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
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
Course achievement	None
Examination	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 Water and Traffic: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective 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	
Typ	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen
Language	DE
Cycle	WiSe
Content	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). 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.
Literature	**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. **Jensen, J. N.**: A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.

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

Course L0402: Water Resource Management	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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: Coastal Hydraulic Engineering I

Courses

Title	Typ	Hrs/wk	CP
Basics of Coastal Engineering (L0807)	Lecture	3	4
Basics of Coastal Engineering (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 reached the following learning results
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 Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.
Assignment for the Following 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

Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe

Content	• Basics of planning and design
	  ◦ Water levels
	  ◦ Currents
	  ◦ Waves
	  ◦ Ice
	• Planning and Design in Coastal Engineering
	  ◦ Functional and constructional design
	  ◦ Determination of design parameters
	  ◦ Design-approaches
	    ▪ Filter
	    ▪ Rubble mound constructions
	    ▪ Piles
	    ▪ Vertical constructions

Literature	Coastal Engineering Manual, CEM Vorlesungsumdruck

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

Module M0923: Integrated Transportation Planning

Courses

Title	Typ	Hrs/wk	CP
Integrated Transportation Planning (L1068)	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 Engineerin
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to: • describe interdependencies between land-use/location choice and 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 an opinion on them.
Skills	Students are able to: • 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 scientific conventions.
Personal Competence	
Social Competence	Students are able to: • 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, acquire the necessary knowledge and use appropriate means for its execution.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment with presentation during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1068: Integrated Transportation Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß
Language	DE
Cycle	WiSe
Content	The course will provide students with an understanding of interdependencies between land-use 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: Underground Constructions

Courses

Title	Typ	Hrs/wk	CP
Applied Tunnel Constructions (L2407)	Lecture	2	3
Steel Structures in Foundation and Hydraulic Engineering (L1146)	Lecture	2	3
Underground Constructions (L0707)	Lecture	1	2
Underground Constructions (L1811)	Recitation Section (large)	1	1

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	Modules from Bachelor studies Civil and environmental engineering: • Geotechnics I-II • Steel Structures I-II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	Capacity for teamwork concerning project management and design of tunnels.
Autonomy	Promotion of independent and creative work flow in the framework of a design exercise.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 minutes
Assignment for the Following Curricula	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

Course L2407: Applied Tunnel Constructions

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe, Tim Babendererde
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1146: Steel Structures in Foundation and Hydraulic Engineering

Typ	Lecture
Hrs/wk	2
CP	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: Underground Constructions	
Typ	Lecture
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Marius Milatz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0969: Selected Topics in Civil Engineering

Courses

Title	Typ	Hrs/wk	CP
Analysis of Offshore Structures (L1867)	Lecture	1	1
Excellence in International Project Delivery (L2387)	Integrated Lecture	2	2
Design of Prefabricated Concrete Structures (L0596)	Lecture	1	1
Design of Prefabricated Concrete Structures (L0597)	Recitation Section (large)	1	1
Forum I - Geotechnics and Construction Management (L1634)	Seminar	1	1
Forum II - Geotechnics and Construction Management (L1635)	Seminar	1	1
Geotechnical Engineering Design (L2447)	Lecture	2	3
Timber Structures (L1151)	Seminar	2	2
Glass Structures (L1152)	Lecture	2	2
Glass Structures (L1447)	Recitation Section (large)	1	1
Special topics of civil engineering 1CP (L2378)		1	1
Special topics of civil engineering 2 LP (L2379)		2	2
Special topics of civil engineering 3 LP (L2380)		3	3
Wind turbine design (L1905)	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 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 of 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, in which fields they want to deepen their knowledge and skills through the election of courses.
Workload in Hours	Depends on choice of courses
Credit points	6
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

Course L1867: Analysis of Offshore Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Mündliche Prüfung
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	Chakrabarti, Handbook of Offshore Engineering, 2005 Sarpkaya, Wave Forces on Offshore Structures, 2010 Faltinsen, Sea Loads on Ships and Offshore Structures, 1998 Sorensen, Basic Coastal Engineering, 2006 Dowling, Mechanical Behavior of Materials, 2007 Haibach, Betriebsfestigkeit, 2006 Marshall, Design of Welded Tubular Connections, 1992 Newland, Random vibrations, spectral and wavelet analysis, 1993

Course L2387: Excellence in International Project Delivery	
Typ	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jens Huckfeldt
Language	EN
Cycle	SoSe
Content	
Literature	

Course L0596: Design of Prefabricated Concrete Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
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 K.-H.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 Teil 2, S. 241-296 • Graubner C.-A. 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
CP	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	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1634: Forum I - Geotechnics and Construction Management	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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 L2447: Geotechnical Engineering Design	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	45 Min.
Lecturer	Prof. Jürgen Grabe, Dr. Tim Pucker
Language	DE
Cycle	WiSe
Content	The focus of the course is on the design of geotechnical structures. Methods and fundamental approaches for the successful processing of geotechnical designs are taught. Theoretical approaches are backed up with examples from everyday work in industry. In parallel to the theoretical content, students are given a practical task for a geotechnical design at beginning of the course, which will be worked on in small teams. In addition to the application of the already acquired technical knowledge, topics like realisation, construction sequence planning, cost calculation, optimisation and evaluation criteria are also part of the course. The event will be finished with the presentation of the designs.
Literature	

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

Course L1152: Glass Structures	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	
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	

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

Course L2378: Special topics of civil engineering 1CP	
Typ	
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2379: Special topics of civil engineering 2 LP	
Typ	
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jan Mittelstädt, Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2380: Special topics of civil engineering 3 LP	
Typ	
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

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

Module M0997: Structural Analysis - Selected Topics

Courses

Title	Typ	Hrs/wk	CP
Plates and Shells (L1199)	Lecture	2	2
Nonlinear Analysis of Frame Structure (L1200)	Lecture	2	2
Nonlinear Analysis of Frame Structure (L1201)	Recitation Section (large)	2	2

Module Responsible	Prof. Uwe Starossek
Admission Requirements	None
Recommended Previous Knowledge	Mechanics I/II, Mathematics I/II, Differential Equations I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of this module, students can explain selected elements of higher structural analysis.
Skills	After successful completion of this module, the students are able to assess the premises and the applicability of the presented methods of advanced structural analysis. They are able to use these methods for performing structural analyses.
Personal Competence	
Social Competence	Students can • 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 voluntarily and independently work homework problems.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	135 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

Course L1199: Plates and Shells	
Typ	Lecture
Hrs/wk	2
CP	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, unveränderter Nachdruck 1986 • Zienkiewicz, O.C. (1977): The Finite Element Method in Enginieering Science. McGraw-Hill, London

Course L1200: Nonlinear Analysis of Frame Structure	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Module M0965: Study Work Structural Engineering

Courses			
Title	**Typ**	**Hrs/wk**	**CP**

Module Responsible	Dozenten des SD B
Admission Requirements	None
Recommended Previous Knowledge	Subjects of the Structural Engineering 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 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. 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 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
Course achievement	None
Examination	Study work
Examination duration and scale	see FSPO
Assignment for the Following Curricula	Civil Engineering: Specialisation Structural Engineering: Compulsory

Module M1505: Adaptation to Climate Change in Hydraulic Engineering (AKWAS)

Courses

Title	Typ	Hrs/wk	CP
Adaptation to climate change in hydraulic engineering (L2291)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	• Hydrology, Hydraulic Engineering • Hydromechanic, Hydraulics • Fundamentals of Coastal Engineering, Coastal- and Flood Protection • Hydrological Systems
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	• Climate protection and climate adaptation • Insights into climate change and its regional characteristics - fundamentals, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle • Fundamentals of analysis of climate data • Consequences of the impact of the climate change • Measures for climate adaptation • Assessment, prioritization and communication of adaptation measures • Fundamentals of the analysis of hydrometeorological and hydrological data
Skills	• Critical thinking: analysis of processes and relations, assessment of needs for action • Creative thinking: development of adaptation strategies and adaptation measures • Practical thinking: inclusion of restrictions, application of calculation approaches, methods, numerical models, planning methods • Consideration of complex tasks
Personal Competence	
Social Competence	• Working in heterogenous groups • Working with different scientific / non-scientific disciplines • Self reflection
Autonomy	• Application oriented use of knowledge and skills • Autonomous work on complex tasks
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Preparation of a written report and a presentation of a complex task.
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 Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L2291: Adaptation to climate change in hydraulic engineering	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	• Climate protection and climate adaptation • Findings on climate change and its regional characteristics: fundamentals of climate change, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle(climate science view) • Fundamentals of the analysis of climate data • Concequences of the impacts of climate change (ingenieering science view) • Measures for climate change adaptation • Assessment, prioritization and communication of measures • Fundamentals of analysis of hydrometeorological and hydrological data
Literature	• Bereitgestellte eLearning Plattform

Specialization Water and Traffic

Module M0964: Structures in Foundation and Hydraulic Engineering

Courses

Title	Typ	Hrs/wk	CP
Applied Tunnel Constructions (L2407)	Lecture	2	3
Steel Structures in Foundation and Hydraulic Engineering (L1146)	Lecture	2	3
Underground Constructions (L0707)	Lecture	1	2
Underground Constructions (L1811)	Recitation Section (large)	1	1

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	Modules from Bachelor studies Civil and environmental engineering: • Geotechnics I-II • Steel Structures I-II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	Capacity for teamwork concerning project management and design of tunnels.
Autonomy	Promotion of independent and creative work flow in the framework of a design exercise.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 minutes
Assignment for the Following Curricula	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

Course L2407: Applied Tunnel Constructions

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe, Tim Babendererde
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1146: Steel Structures in Foundation and Hydraulic Engineering

Typ	Lecture
Hrs/wk	2
CP	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: Underground Constructions	
Typ	Lecture
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Marius Milatz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0595: Examination of Materials, Structural Condition and Damages

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Examination of Materials, Structural Condition and Damages (L0260)	Lecture	3	4
Examination of Materials, Structural Condition and Damages (L0261)	Recitation Section (small)	1	2

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge about building materials or material science, for example by the module 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 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, 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 make the timing and the operation steps to learn the specialist knowledge of a very extensive field.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 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

Typ	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
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

Typ	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0923: Integrated Transportation Planning

Courses

Title	Typ	Hrs/wk	CP
Integrated Transportation Planning (L1068)	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 Engineerin
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to: • describe interdependencies between land-use/location choice and 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 an opinion on them.
Skills	Students are able to: • 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 scientific conventions.
Personal Competence	
Social Competence	Students are able to: • 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, acquire the necessary knowledge and use appropriate means for its execution.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment with presentation during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1068: Integrated Transportation Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz, Dr. Philine Gaffron, Jacqueline Bianca Maaß
Language	DE
Cycle	WiSe
Content	The course will provide students with an understanding of interdependencies between land-use 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: Water Resources and -Supply

Courses

Title	Typ	Hrs/wk	CP
Chemistry of Drinking Water Treatment (L0311)	Lecture	2	1
Chemistry of Drinking Water Treatment (L0312)	Recitation Section (large)	1	2
Water Resource Management (L0402)	Lecture	2	2
Water Resource Management (L0403)	Recitation Section (small)	1	1

Module Responsible	Prof. Mathias Ernst
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of water management and the key processes involved in water treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
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
Course achievement	None
Examination	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 Water and Traffic: Compulsory Civil Engineering: Specialisation Coastal Engineering: Elective 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	
Typ	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen
Language	DE
Cycle	WiSe
Content	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). 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.
Literature	**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. **Jensen, J. N.**: A Problem Solving Approach to Aquatic Chemistry. John Wiley & Sons, Inc., New York, 2003.

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

Course L0402: Water Resource Management	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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: Environmental Protection and Management

Courses

Title	Typ	Hrs/wk	CP
Integrated Pollution Control (L0502)	Lecture	2	2
Health, Safety and Environmental Management (L0387)	Lecture	2	3
Health, Safety and Environmental Management (L0388)	Recitation Section (small)	1	1

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	• Good knowledge in Technologies for Environmental Protection (end-of-pipe, integrated solutions) • Good knowledge of the relevant Environmental Legislation • Basic knowledge of instruments for Environmental Assessment
Educational Objectives	After taking part successfully, students have reached the following learning results
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 problems and situations in the field of environmental protection. They can consider the best available techniques and to plan and suggest concrete actions in a company- or branch-specific context. By this means they can solve problems on a technical, administrative and legislative level.
Personal Competence	
Social Competence	The students can work together in international 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
Course achievement	None
Examination	Written exam
Examination duration and scale	90 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

Course L0502: Integrated Pollution Control	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	The lecture focusses on: • 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	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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

Module M0902: Wastewater Treatment and Air Pollution Abatement

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Biological Wastewater Treatment (L0517)	Lecture	2	3
Air Pollution Abatement (L0203)	Lecture	2	3

Module Responsible	Dr. Ernst-Ulrich Hartge
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge of biology and chemistry basic knowledge of solids process engineering and separation technology
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of the module students are able to • name and explain biological processes for waste water treatment, • characterize waste water and sewage sludge • discuss legal regulations in the area of emissions and air quality • classify off gas tretament processes and to define their area of application
Skills	Students are able to • choose and design processs steps for the biological waste water treatment • combine processes for cleaning of off-gases depending on the pollutants contained in the gases
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	90 min
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 Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Specialisation Waste and Energy: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory Renewable Energies: Specialisation Bioenergy Systems: Elective Compulsory 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

Course L0517: Biological Wastewater Treatment

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	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

Literature	**Gujer, Willi** Siedlungswasserwirtschaft : mit 84 Tabellen ISBN: 3540343296 (Gb.) URL: http://www.gbv.de/dms/bs/toc/516261924.pdf URL: 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.) URL: http://www.gbv.de/du/services/agi/52567E5D44DA0809C12570220050BF25/000000700334 Donaueschingen-Pfohren : Mall-Beton-Verl., 2000 TUB_HH_Katalog **Mudrack, Klaus** (Kunst, Sabine;) Biologie der Abwasserreinigung : 18 Tabellen ISBN: 382741427X URL: http://www.gbv.de/du/services/agi/94B581161B6EC747C1256E3F005A8143/420000114903 Heidelberg [u.a.] : Spektrum, Akad. Verl., 2003 TUB_HH_Katalog **Tchobanoglous, George** (Metcalf & Eddy, Inc., ;) Wastewater engineering : treatment and reuse 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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Ernst-Ulrich Hartge, Dr. Swantje Pietsch-Braune
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

Module M0826: Biology, Geology and Chemistry

Courses

Title	Typ	Hrs/wk	CP
Biology (L1428)	Lecture	2	2
Geology and Soil Science (L0903)	Lecture	2	1
Environmental Analysis (L0354)	Lecture	2	3

Module Responsible	Dr. Dorothea Rechtenbach
Admission Requirements	None
Recommended Previous Knowledge	Fundamentals of inorganic/organic chemistry and biology (knowledge 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 technical and scientific tasks within a seminar subject specific and interdisciplinary .
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 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	2 Std. 15 Min.
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Water and Environmental Engineering: Core Qualification: Compulsory

Course L1428: Biology

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Anna Krüger, Prof. Garabed Antranikian
Language	DE
Cycle	WiSe
Content	
Literature	Umweltmikrobiologie, Reineke, W. und Schlömann, M. (2015) 2. Aufl., Springer Spektrum Verlag

Course L0903: Geology and Soil Science

Typ	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth, Sonja Götz
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Dorothea Rechtenbach, Dr. Henning Mangels
Language	EN
Cycle	WiSe
Content	Introduction Sampling in different environmental compartments, sample transportation, sample storage Sample preparation Photometry Wastewater analysis Introduction into chromatography Gas chromatography HPLC Mass spectrometry Optical emission spectrometry Atom absorption spectrometry Quality assurance in environmental analysis
Literature	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 Iannelli (Translator), Eric Iannelli (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 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) Royal Society of Chemistry, Atomic absorption spectometry (http://www.kau.edu.sa/Files/130002/Files/6785_AAs.pdf)

Module M1403: Construction and Simulation of Sewerage Systems

Courses

Title	Typ	Hrs/wk	CP
Construction and renovation of urban sewer systems (L1998)	Seminar	3	3
Simulation of sewerage systems (L2006)	Seminar	3	3

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	• Hydraulics in pipes and gravity-sewers • Mechanics • Soil mechanics and foundation engineering • Knowledge about urban sewerage systems and water management
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students can describe urban wastewater systems by means of software-based modeling. In case studies they can perform system and weak point analyzes. In addition, they can analyze the hydraulic effects quantitatively. Furthermore, they have the knowledge to comprehend flow events in gravity-sewers based on the St. Venant equations. Students have knowledge of static and structural requirements of the sewer system. Cases of damage are investigated and the knowledge regarding different renovation technologies for sewer systems is acquired.
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 in a team and can impart this knowledge.
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 96, Study Time in Lecture 84
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** No / 20 % / Presentation
Examination	Written elaboration
Examination duration and scale	nach Absprache
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory

Course L1998: Construction and renovation of urban sewer systems	
Typ	Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ingo Weidlich
Language	EN
Cycle	WiSe
Content	The lecture focusses on construction and renovation of urban sewer pipelines. 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
Literature	Nr. / Titel 1 ATV A 127, Abwassertechnische Vereinigung e.V., Arbeitsblatt A 127, Regelwerk Abwasser-Abfall, Vertrieb: GFA, DK 628.22 (083),A 127, 2000 2 DIN EN 1610, Verlegung und Prüfung von Abwasserleitungen und -kanälen, Beuth Verlag, Berlin, 1997 3 Arbeitsblatt DWA-A 143-1, Sanierung von Entwässerungssystemen außerhalb von Gebäuden, Teil 1: Planung und Überwachung von Sanierungsmaßnahmen Februar 2015 4 Arbeitsblatt DWA-A 143-2, Sanierung von Entwässerungssystemen außerhalb von Gebäuden Teil 2: Statische Berechnung zur Sanierung von Abwasserleitungen und -kanälen mit Lining und Montageverfahren, Juli 2015 5 DIN EN 752:2008, 2008: Entwässerungssysteme außerhalb von Gebäuden - Kanalmanagement. 6 Zeitschrift 3R, Fachzeitschrift für sichere und effiziente Rohrleitungssysteme 7 Handbuch für den Rohrleitungsbau Band 1 und 2, 4. Auflage, Günter Wossog, 2015 8 Rohrleitungstechnik, Walter Wagner, Vogel Buchverlag, 2006 9 Stein D., Stein R., „Instandhaltung von Kanalisationen", 1008 S., ISBN 978-3-9810648-4-1 | Verlag Prof. Dr.-Ing. Stein & Partner GmbH, 2014 10 Stein, D., „Grabenloser Leitungsbau", 1. Auflage, Gebundene Ausgabe - 1166 Seiten, Ernst & Sohn Verlag, 2003, ISBN: 3433017786 11 Willoughby D:A: „Horizontal Directional Drilling: Utility and Pipeline Applications" Digital Engineering Library @ 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: Simulation of sewerage systems	
Typ	Seminar
Hrs/wk	3
CP	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: Wastewater Systems

Courses

Title	Typ	Hrs/wk	CP
Wastewater Systems - Collection, Treatment and Reuse (L0934)	Lecture	2	2
Wastewater Systems - Collection, Treatment and Reuse (L0943)	Recitation Section (large)	1	1
Advanced Wastewater Treatment (L0357)	Lecture	2	2
Advanced Wastewater Treatment (L0358)	Recitation Section (large)	1	1

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of wastewater management and the key processes involved in wastewater treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students are able to outline key areas of the full range of treatment systems in waste water management, as well as their mutual dependence for sustainable water protection. They can describe relevant economic, environmental and social factors.
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 Lecture 84
Credit points	6
Course achievement	None
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: Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory Energy and Environmental Engineering: Specialisation Environmental Engineering: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory International Management and Engineering: Specialisation II. Process Engineering and Biotechnology: Elective Compulsory Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process Engineering: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L0934: Wastewater Systems - Collection, Treatment and Reuse	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0357: Advanced Wastewater Treatment	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Survey on advanced wastewater treatment reuse of reclaimed municipal wastewater Precipitation Flocculation Depth filtration 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	SoSe
Content	Aggregate organic compounds (sum parameters) Industrial wastewater Processes for industrial wastewater treatment Precipitation 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	Typ	Hrs/wk	CP
Noise Protection (L1109)	Lecture	2	2
Urban Infrastructures (L0874)	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 protection • General knowledge of scientific writing/working
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 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 international 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	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Written Report plus oral 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: Elective Compulsory Environmental Engineering: Core Qualification: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Core Qualification: Compulsory Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1109: Noise Protection

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Jäschke
Language	EN
Cycle	SoSe
Content	
Literature	1) Müller & Möser (2013): Handbook of Engineering Acoustics (also available in German) 2) WHO (1999): Guidelines for Community Noise 3) Environmental Noise Directive 2002/49/EG 4) ISO 9613-2 (1996): Acoustics, Attenuation of sound during propagation outdoors, Part 2: General method of calculation

Course L0874: Urban Infrastructures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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 M0703: Soil and Groundwater Contamination

Courses

Title	Typ	Hrs/wk	CP
Contamination and Remediation (L0547)	Project Seminar	3	3
NAPL in Soil and Groundwater (L0545)	Lecture	1	1
NAPL in Soil and Groundwater (L0546)	Recitation Section (small)	2	2

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	• Ground water hydrology • Geohydraulic and solute transport • Hydromechanics
Educational Objectives	After taking part successfully, students have reached the following learning results
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 faminliar with Monitored 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	
Social Competence	The students are able to prepare complex contamination issues in teamwork and are able to find remediation measures.
Autonomy	None
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	Klausur 60 min; Referat 15 min;
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: 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 L0547: Contamination and Remediation

Typ	Project Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Wilfried Schneider
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 in Soil and Groundwater

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Wilfried Schneider
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wilfried Schneider
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1351: Construction Processes

Courses

Title	Typ	Hrs/wk	CP
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 successfully, students have reached the following learning results
Professional Competence	
Knowledge	
Skills	
Personal Competence	
Social Competence	
Autonomy	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 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 L1908: Digital Building

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	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

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Markus Salge
Language	DE
Cycle	SoSe
Content	
Literature	

Module M0871: Hydrological Systems

Courses

Title	Typ	Hrs/wk	CP
Applied Surface Hydrology (L0289)	Lecture	2	2
Applied Surface Hydrology (L1412)	Project-/problem-based Learning	1	2
Interaction Water - Environment in Fluvial Areas (L0295)	Project-/problem-based Learning	1	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	Fundamentals of Hydromechanics and Hydraulic Engineering: Hydraulic Engineering I and Hydraulic Engineering II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 problems
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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

Course L0289: Applied Surface Hydrology

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	Basics of hydrology: • Hydrological cycle • Data acquisition • Data analyses and statistical assessment • Statistics of extremes • Regionalization methods for hydrological values • Rainfall-run-off modelling on the basis of a unit hydrograph conceps • 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 Surface Hydrology	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0295: Interaction Water - Environment in Fluvial Areas	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE/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 M0875: Nexus Engineering - Water, Soil, Food and Energy

Courses

Title	Typ	Hrs/wk	CP
Ecological Town Design - Water, Energy, Soil and Food Nexus (L1229)	Seminar	2	2
Water & Wastewater Systems in a Global Context (L0939)	Lecture	2	4

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge of the global situation with rising poverty, soil degradation, migration to cities, lack of water resources and sanitation
Educational Objectives	After taking part successfully, students have reached the following learning results
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 socio-economic conditions for the main climates around the world.
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
Credit points	6
Course achievement	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 can be found at the beginning of the smester in the StudIP course module handbook.
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 Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L1229: Ecological Town Design - Water, Energy, Soil and Food Nexus	
Typ	Seminar
Hrs/wk	2
CP	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 & Wastewater Systems in a Global Context	
Typ	Lecture
Hrs/wk	2
CP	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)

Module M0922: City Planning

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
City Planning (L1066)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Carsten Gertz
Admission Requirements	None
Recommended Previous Knowledge	for "Principles of Urban Planning": none for "Designing Urban Streetscapes": some knowledge of transport planning, e.g. through taking the undergraduate class „Transport Planning and Traffic Engineering“
Educational Objectives	After 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 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	
Social Competence	Students are able to: • 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 pre-defined 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
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment, designwork during the semester
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 Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Compulsory

Course L1066: City Planning	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	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: Construction Logistics and Project Management

Courses

Title	Typ	Hrs/wk	CP
Construction Logistics (L1163)	Lecture	1	2
Construction Logistics (L1164)	Recitation Section (small)	1	2
Project Development and Management (L1161)	Lecture	1	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 have reached the following learning results
Professional Competence	
Knowledge	Students can... • 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	Students can... • 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	
Social Competence	Students can... • hold presentations in and for groups • apply methods of conflict solving 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	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Two written papers with presentations
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 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	
Typ	Lecture
Hrs/wk	1
CP	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 • 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 and waste removel logistics) • best practice examples (construction logistics Potsdamer Platz, recent case study of the region) Contents of the lecture are deepened in special exercises.
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: Construction Logistics	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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	
Typ	Lecture
Hrs/wk	1
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	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 M0593: Building Materials and Building Preservation

Courses

Title	Typ	Hrs/wk	CP
Repair of Structures (L0255)	Lecture	1	1
Mineral Building Materials (L0253)	Lecture	2	2
Technology of mineral Building Materials (L0256)	Project-/problem-based Learning	1	2
Transport Processes in Building Materials and Damage Processes (L0254)	Lecture	1	1

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	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 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 present 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** Yes / 20 % / Subject theoretical and practical work /
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 L0255: Repair of Structures

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Design and production of a special mineral building material
Literature	Taylor, H.F.W.: Cement Chemistry Springenschmid, R.: Betontechnologie für die Praxis

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

Module M0998: Statics and Dynamics of Structures

Courses

Title	Typ	Hrs/wk	CP
Structural Dynamics (L1202)	Lecture	2	2
Structural Dynamics (L1203)	Recitation Section (large)	2	2
Fracture mechanics and fatigue in steel structures (L0564)	Lecture	1	1
Fracture Mechanics and Fatigue (L0565)	Recitation Section (large)	1	1

Module Responsible	Prof. Uwe Starossek
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of linear structural analysis of statically determinate and indeterminate structures; Mechanics I/II, Mathematics I/II, Differential equations I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After successful completion of this module, the student can explain the basic aspects of dynamic effects on structures and the respective methods.
Skills	After successful completion of this module, the students will be able to predict the response of material and structures to dynamics loading using the appropriate computational approaches and methods.
Personal Competence	
Social Competence	Students can • 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	Students are able to gain knowledge of the subject area from given and other sources and apply it to new problems. Furthermore, they are able to structure the solution process for problems in the area of Structural Analysis.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	150 min
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 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
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L0564: Fracture mechanics and fatigue in steel structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ingo Hadrych
Language	DE
Cycle	SoSe
Content	• 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 accumulation formula 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 in different examples.
Literature	• Seeßelberg, C.; Kranbahnen - Bemessung und konstruktive Gestaltung; 3. Auflage; Bauwerk-Verlag; Berlin 2009 • Kuhlmann, Dürr, Günther; Kranbahnen und Betriebsfestigkeit; in Stahlbau Kalender 2003; Verlag Ernst & Sohn; Berlin 2003 • Deutscher Stahlbau-Verband (Hrsg.); Stahlbau Handbuch Band 1 Teil B; 3. Auflage; 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 1-1: Allgemeine Bemessungsregeln, Bemessungsregeln für den Hochbau; 1993 • DIN V ENV 1993-6: Eurocode 3; Bemessung und Konstruktion von Stahlbauwerken; Teil 6: Kranbahnen; 2001 • DIN-Fachbericht 126. Richtlinie zur Anwendung von DIN V ENV 1993-6; Nationales Anwendungsdokument (NAD); Berlin 2002

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

Module M0982: Transportation Modelling

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
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 have reached the following learning results
Professional Competence	
Knowledge	Students are able to understand the operation and potential applications of transport 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	Students are able to independently develop and document solutions.
Autonomy	Students are able to: • independently organise, manage and solve set tasks. • independently prepare written reports.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	written assignment with presentation during the semester
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Compulsory Logistics, Infrastructure and Mobility: Specialisation Infrastructure and Mobility: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L1180: Transportation Modelling

Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	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.

Module M0749: Waste Treatment and Solid Matter Process Technology

Courses

Title	Typ	Hrs/wk	CP
Solid Matter Process Technology for Biomass (L0052)	Lecture	2	2
Thermal Waste Treatment (L0320)	Lecture	2	2
Thermal Waste Treatment (L1177)	Recitation Section (large)	1	2

Module Responsible	Prof. Kerstin Kuchta
Admission Requirements	None
Recommended Previous Knowledge	Basics of • thermo dynamics • fluid dynamics • chemistry
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students can name, describe current issue and problems in the field of thermal waste treatment and particle process engineering and contemplate them in the context of their field. The industrial application of unit operations as part of process engineering is explained by actual examples of waste incineration technologies and solid biomass processes. Compostion, particle sizes, transportation and dosing, drying and agglomeration of renewable resources and wastes are described as important unit operations when producing solid fuels and bioethanol, producing and refining edible oils, electricity , heat and mineral recyclables.
Skills	The students are able to select suitable processes for the treatment of wastes or raw material with respect to their characteristics and the process aims. They can evaluate the efforts and costs for processes and select economically feasible treatment concepts.
Personal Competence	
Social Competence	Students can • respectfully work together as a team and discuss technical tasks • participate in subject-specific and interdisciplinary discussions, • develop cooperated solutions • promote the scientific development and accept professional constructive criticism.
Autonomy	Students can independently tap knowledge of the subject area and transform it to new questions. They are capable, in consultation with supervisors, 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 Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 min
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory 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. Renewable Energy: Elective Compulsory 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 Matter Process Technology for Biomass	
Typ	Lecture
Hrs/wk	2
CP	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: Thermal Waste Treatment	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0827: Modeling in Water Management

Courses

Title	Typ	Hrs/wk	CP
Applied Groundwater Modeling (L0543)	Lecture	1	1
Applied Groundwater Modeling (L0544)	Recitation Section (small)	2	2
Modeling of Water Supply and Sewer Network (L0875)	Project-/problem-based Learning	2	3

Module Responsible	Dr. Klaus Johannsen
Admission Requirements	None
Recommended Previous Knowledge	Groundwater • groundwater hydraulics and transport of substances Pipe Systems • Knowledge on urban water infrastructures, in particular drinking water systemsand urban drainage systems including special structures • Hydraulics of drinking water supply systems and sewer systems • Basic knowledge on water management
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 interdependencies of hydraulic and toxic phenomena in soil and water.
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	Wird nicht vermittelt.
Autonomy	Wird nicht vermittelt.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	20 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 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

Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0875: Modeling of Water Supply and Sewer Network	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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: Management of Surface Water

Courses

Title	Typ	Hrs/wk	CP
Modelling of Flow in Rivers and Estuaries (L0810)	Lecture	3	4
Nature-Oriented Hydraulic Engineering / Integrated Flood Protection (L0961)	Project-/problem-based Learning	2	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	Fundamentals of Hydromechanics, Hydraulics, Hydrology and Hydraulic Engineering; Hydraulic Engineering I and Hydraulic Engineering II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 problems.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 150 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: 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: Compulsory Water and Environmental Engineering: Specialisation Environment: Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0810: Modelling of Flow in Rivers and Estuaries

Typ	Lecture
Hrs/wk	3
CP	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 • 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

Course L0961: Nature-Oriented Hydraulic Engineering / Integrated Flood Protection	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. 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 M0860: Harbour Engineering and Harbour Planning

Courses

Title	Typ	Hrs/wk	CP
Harbour Engineering (L0809)	Lecture	2	2
Harbour Engineering (L1414)	Project-/problem-based Learning	1	2
Port Planning and Port Construction (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 learning results
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 Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	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.
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory Theoretical Mechanical Engineering: Technical Complementary Course: Elective Compulsory

Course L0809: Harbour Engineering

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	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	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0378: Port Planning and Port Construction	
Typ	Lecture
Hrs/wk	2
CP	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
Literature	Vorlesungsumdruck, s. www.tu-harburg.de/gbt

Module M0857: Geochemical Engineering

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Contaminated Sites and Landfilling (L0906)	Lecture	2	2
Contaminated Sites and Landfilling (L0907)	Recitation Section (large)	1	2
Geochemical Engineering (L0904)	Lecture	2	2

Module Responsible	Dr. Marco Ritzkowski
Admission Requirements	None
Recommended Previous Knowledge	Module: General and Inorganic Chemistry, Module:Organic Chemistry, Biology (Basic Knowledge)
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 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 and interdisciplinary .
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 Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	2 hours
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Environmental Engineering: Core Qualification: 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 L0906: Contaminated Sites and Landfilling

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Marco Ritzkowski, Dr. Joachim Gerth
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: Contaminated Sites and Landfilling	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. Marco Ritzkowski, Dr. Joachim Gerth
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0904: Geochemical Engineering	
Typ	Lecture
Hrs/wk	2
CP	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

Module M1350: Excavation Law and Projects

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Subsoil and Underground Engineering Law (L0395)	Lecture	2	2
Service Contract and Procurement Law (L1906)	Lecture	2	2
Project Geotechnics (L0708)	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	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Oral exam
Examination duration and scale	15 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: Subsoil and Underground Engineering Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk
Language	DE
Cycle	WiSe
Content	• History of Civil Engineering Law (from 1700 BC to 2000 AD) • Basics of foundation and excarvation law / engineering law (the participants in the case law of geotechnical law case studies) • Legal aspects of technical regulations in civil engineering (with case studies) • The civil engineering contract (including checklists for the special civil engineering contract design and execution) • The liability of the planner and entrepreneur in civil engineering (practical examples, jurisprudence and law, inter alia, to the Ordinance on Combatants, liability for defects and traffic safety obligations, construction law and insurance questions) • The ground / foundation risk and the systemic risk (also in the European context) • The total debt in (low) building law (based on practice-oriented case constellations) • The (construction) conflict, the dispute avoidance models and the construction process (practice-oriented presentation)
Literature	Folienskript (in der Vorlesung erhältlich) weitere Literatur: • Englert, Grauvogel und Maurer: Handbuch des Baugrund- und Tiefbaurechts. Werner-Verlag

Course L1906: Service Contract and Procurement Law

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günther Schalk, Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	
Literature	

Course L0708: Project Geotechnics	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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 M0705: Groundwater

Courses

Title	Typ	Hrs/wk	CP
Geohydraulic and Solute Transport (L0539)	Lecture	2	2
Geohydraulic and Solute Transport (L0540)	Recitation Section (small)	1	1
Simulation in Groundwater Hydrology (L0541)	Lecture	1	1
Simulation in Groundwater Hydrology (L0542)	Recitation Section (small)	2	2

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	• Ground water hydrology • Hydromechanics
Educational Objectives	After taking part successfully, students have reached the following learning 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 Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	60 min written exam and written papers
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 Process Engineering: Specialisation Environmental Process Engineering: Elective Compulsory Process Engineering: Specialisation Process 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 L0539: Geohydraulic and Solute Transport

Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0541: Simulation in Groundwater Hydrology	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sonja Götz
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	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sonja Götz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0619: Waste Treatment Technologies

Courses

Title	Typ	Hrs/wk	CP
Waste and Environmental Chemistry (L0328)	Practical Course	2	2
Biological Waste Treatment (L0318)	Project-/problem-based Learning	3	4

Module Responsible	Prof. Kerstin Kuchta
Admission Requirements	None
Recommended Previous Knowledge	chemical and biological basics
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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 Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
Examination	Presentation
Examination duration and scale	Elaboration and Presentation (15-25 minutes in groups)
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

Course L0328: Waste and Environmental Chemistry	
Typ	Practical Course
Hrs/wk	2
CP	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	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Kerstin Kuchta
Language	EN
Cycle	WiSe
Content	1. Introduction 2. biological basics 3. determination process specific material characterization 4. aerobic degradation (Composting, stabilization) 5. anaerobic degradation (Biogas production, fermentation) 6. Technical layout and process design 7. Flue gas treatment 8. Plant design practical phase
Literature	

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

Courses

Title	Typ	Hrs/wk	CP
Rural Development and Resources Oriented Sanitation for different Climate Zones (L0942)	Seminar	2	3
Rural Development and Resources Oriented Sanitation for different Climate Zones (L0941)	Lecture	2	3

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge of the global situation with rising poverty, soil degradation, lack of water resources and sanitation
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	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. 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
Credit points	6
Course achievement	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.
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 Energy and Environmental Engineering: Specialisation Energy and Environmental Engineering: Elective Compulsory Environmental Engineering: Specialisation Water: Elective Compulsory International Management and Engineering: Specialisation II. Energy and Environmental Engineering: Elective Compulsory Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory 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: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0942: Rural Development and Resources Oriented Sanitation for different Climate Zones	
Typ	Seminar
Hrs/wk	2
CP	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 Development and Resources Oriented Sanitation for different Climate Zones	
Typ	Lecture
Hrs/wk	2
CP	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: Process Modeling in Water Technology

Courses

Title	Typ	Hrs/wk	CP
Process Modelling of Wastewater Treatment (L0522)	Project-/problem-based Learning	2	3
Process Modeling in Drinking 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 in drinking water and waste water treatment.
Educational Objectives	After taking part successfully, students have reached the following learning results
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	
Social Competence	Students are able to solve problems and document solutions in a group with members of different technical background. They are able to give appropriate feedback and can work constructively with feedback concerning their work.
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 Lecture 56
Credit points	6
Course achievement	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 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: Elective Compulsory Water and Environmental Engineering: Specialisation Cities: Elective Compulsory

Course L0522: Process Modelling of Wastewater Treatment	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Joachim Behrendt
Language	DE/EN
Cycle	WiSe
Content	Mass and energy balances Tracer modelling Activated Sludge Model 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: Process Modeling in Drinking Water Treatment	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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 carbon 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 explainded 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: Special Aspects of Waste Resource Management

Courses

Title	Typ	Hrs/wk	CP
Advanced Topics in Waste Resource Management (L1055)	Project-/problem-based Learning	3	3
International Waste Management (L0317)	Project-/problem-based Learning	2	3

Module Responsible	Prof. Kerstin Kuchta
Admission Requirements	None
Recommended Previous Knowledge	basics in waste treatment technologies
Educational Objectives	After taking part successfully, students have reached the following learning results
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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes · **Bonus** 20 % · **Form** Written elaboration · **Description**
Examination	Presentation
Examination duration and scale	PowerPoint presentation (10-15 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

Typ	Project-/problem-based Learning
Hrs/wk	3
CP	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: International Waste Management	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	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: Concrete Structures

Courses

Title	Typ	Hrs/wk	CP
Concrete Structures (L0579)	Seminar	1	1
Structural Concrete Members (L0577)	Lecture	2	3
Structural Concrete Members (L0578)	Recitation Section (large)	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basics of structural analysis, conception and dimensioning of structural concrete Modules: Reinforced Concrete Structures I+II, Structural Analysis I+II, Mechanics I+II
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Presentation; **Description** Es werden 2 Referate ausgegeben
Examination	Written exam
Examination duration and scale	120 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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L0579: Concrete Structures

Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Björn Schütte
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	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	• 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 können im STUDiP heruntergeladen werden • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Ingenieurbau. Springer, Heidelberg 2010 • König, G., Liphardt S.: Hochhäuser aus Stahlbeton, Betonkalender 2003, Teil II, Seite 1-69, Verlag Ernst & Sohn, Berlin 2003 • Phocas, Marios C.: Hochhäuser : Tragwerk und Konstruktion, Stuttgart, Teubner, 2005 • Deutscher Ausschuss für Stahlbeton: Heft 600: Erläuterungen zu DIN EN 1992-1-1, Beuth Verlag, Berlin 2012 • Deutscher Ausschuss für Stahlbeton: Heft 240: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken, Verlag Ernst & Sohn, Berlin 1978 • Stiglat, K., Wippel, H.: Massive Platten - Ausgewählte Kapitel der Schnittkraftermittlung und Bemessung, Betonkalender 1992, Teil I, 287-366, Verlag Ernst & Sohn, Berlin 1992 • Stiglat/Wippel: Platten. Verlag Ernst & Sohn, Berlin,1973 • Schlaich J.; Schäfer K.: Konstruieren im Stahlbetonbau. Betonkalender 1998, Teil II, S. 721ff, Verlag Ernst & Sohn, Berlin, 1998 • Dames K.-H.: Rohbauzeichnungen Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997

Course L0578: Structural Concrete Members	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Björn Schütte
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0722: Computational Analysis of Concrete Structures

Courses			
Title	**Typ**	**Hrs/wk**	**CP**
Computational Analysis of Concrete Structures (L0598)	Lecture	2	3
Computational Analysis of Concrete Structures (L0599)	Recitation Section (large)	1	1
FE-Modeling of Concrete Structures (L0600)	Project-/problem-based Learning	2	2

Module Responsible	Prof. Günter Rombach
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge in structural analysis and design of reinforced concrete structures (beams, slabs, shear walls). Lectures 'Concrete Structures I und II' Lectures 'Structural Analysis I and II' 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 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 110, Study Time in Lecture 70
Credit points	6
Course achievement	**Compulsory** / **Bonus** / **Form** / **Description** Yes / None / Attestation / Am Ende des Semster ist ein Tragsystem mit dem Rechenprogramm zu modellieren Yes / None / Excercises / Es ist ein Tragsystem mit TEDDY zu modellieren
Examination	Oral exam
Examination duration and scale	45 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

Course L0598: Computational Analysis of Concrete Structures

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	• 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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0600: FE-Modeling of Concrete Structures	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. 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. C1.-C.36)

Module M0963: Steel and Composite Structures

Courses

Title	Typ	Hrs/wk	CP
Steel and Composite Structures (L1204)	Lecture	2	2
Steel and Composite Structures (L1205)	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 Structures I and II, BUBC)
Educational Objectives	After taking part successfully, students have reached the following learning 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 sttructures • 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	--
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	180 min
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 Civil Engineering: Specialisation Water and Traffic: Elective Compulsory International Management and Engineering: Specialisation II. Civil Engineering: Elective Compulsory

Course L1204: Steel and Composite Structures

Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (large)
Hrs/wk	2
CP	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

Course L1097: Steel Bridges	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Jörg Ahlgrimm
Language	DE
Cycle	WiSe
Content	**Lecture Contents ‚Steel Bridge Construction'** **Dr.-Ing. 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) - 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 über die Fulda, Stahlbau 74 (2005), Heft 2, S. 114

Module M0969: Selected Topics in Civil Engineering

Courses

Title	Typ	Hrs/wk	CP
Analysis of Offshore Structures (L1867)	Lecture	1	1
Excellence in International Project Delivery (L2387)	Integrated Lecture	2	2
Design of Prefabricated Concrete Structures (L0596)	Lecture	1	1
Design of Prefabricated Concrete Structures (L0597)	Recitation Section (large)	1	1
Forum I - Geotechnics and Construction Management (L1634)	Seminar	1	1
Forum II - Geotechnics and Construction Management (L1635)	Seminar	1	1
Geotechnical Engineering Design (L2447)	Lecture	2	3
Timber Structures (L1151)	Seminar	2	2
Glass Structures (L1152)	Lecture	2	2
Glass Structures (L1447)	Recitation Section (large)	1	1
Special topics of civil engineering 1CP (L2378)		1	1
Special topics of civil engineering 2 LP (L2379)		2	2
Special topics of civil engineering 3 LP (L2380)		3	3
Wind turbine design (L1905)	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 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 of 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, in which fields they want to deepen their knowledge and skills through the election of courses.
Workload in Hours	Depends on choice of courses
Credit points	6
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

Course L1867: Analysis of Offshore Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Mündliche Prüfung
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	Chakrabarti, Handbook of Offshore Engineering, 2005 Sarpkaya, Wave Forces on Offshore Structures, 2010 Faltinsen, Sea Loads on Ships and Offshore Structures, 1998 Sorensen, Basic Coastal Engineering, 2006 Dowling, Mechanical Behavior of Materials, 2007 Haibach, Betriebsfestigkeit, 2006 Marshall, Design of Welded Tubular Connections, 1992 Newland, Random vibrations, spectral and wavelet analysis, 1993

Course L2387: Excellence in International Project Delivery	
Typ	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jens Huckfeldt
Language	EN
Cycle	SoSe
Content	
Literature	

Course L0596: Design of Prefabricated Concrete Structures	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
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 K.-H.: Modellierung der D-Bereiche von Fertigteilen. Betonkalender 2005 Teil 2, S. 241-296 • Graubner C.-A. 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
CP	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	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1634: Forum I - Geotechnics and Construction Management	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	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 L2447: Geotechnical Engineering Design	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	45 Min.
Lecturer	Prof. Jürgen Grabe, Dr. Tim Pucker
Language	DE
Cycle	WiSe
Content	The focus of the course is on the design of geotechnical structures. Methods and fundamental approaches for the successful processing of geotechnical designs are taught. Theoretical approaches are backed up with examples from everyday work in industry. In parallel to the theoretical content, students are given a practical task for a geotechnical design at beginning of the course, which will be worked on in small teams. In addition to the application of the already acquired technical knowledge, topics like realisation, construction sequence planning, cost calculation, optimisation and evaluation criteria are also part of the course. The event will be finished with the presentation of the designs.
Literature	

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

Course L1152: Glass Structures	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	
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	

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

Course L2378: Special topics of civil engineering 1CP	
Typ	
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2379: Special topics of civil engineering 2 LP	
Typ	
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dr. Jan Mittelstädt, Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2380: Special topics of civil engineering 3 LP	
Typ	
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

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

Module M0699: Geotechnics III

Courses

Title	Typ	Hrs/wk	CP
Soil Laboratory Course (L0499)	Practical Course	1	2
Numerical Methods in Geotechnics (L0375)	Lecture	3	3
Advanced Foundation Engineering (L0497)	Lecture	2	2
Advanced Foundation Engineering (L0498)	Recitation Section (large)	1	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 82, Study Time in Lecture 98
Credit points	6
Course achievement	**Compulsory** Yes; **Bonus** None; **Form** Subject theoretical and practical work; **Description**
Examination	Written exam
Examination duration and scale	120 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

Typ	Practical Course
Hrs/wk	1
CP	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 L0375: Numerical Methods in Geotechnics	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Hans Mathäus Stanford
Language	DE
Cycle	WiSe
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

Course L0497: Advanced Foundation Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
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	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0864: Practical Course in Water and Wastewater Technology

Courses

Title	Typ	Hrs/wk	CP
Practical Course in Water and Wastewater Technology I (L0503)	Practical Course	2	3
Practicle Course of Wastewater Technology II (L0607)	Practical Course	3	3

Module Responsible	Dr. Dorothea Rechtenbach
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge in chemistry and physics (knowledge acquired at school)
Educational Objectives	After taking part successfully, students have reached the following learning results
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 experiments following written procedures without external assistance.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	ca. 5 Stunden
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: 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 L0503: Practical Course in Water and Wastewater Technology I

Typ	Practical Course
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Dorothea Rechtenbach
Language	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: Practicle Course of Wastewater Technology II

Typ	Practical Course
Hrs/wk	3
CP	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 M1401: Study work Water and Traffic

Courses			
Title	**Typ**	**Hrs/wk**	**CP**

Module Responsible	Dozenten des SD B
Admission Requirements	None
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
Course achievement	None
Examination	Study work
Examination duration and scale	See FSPO
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Compulsory

Module M0581: Water Protection

Courses

Title	Typ	Hrs/wk	CP
Water Protection and Wastewater Management (L0226)	Lecture	3	3
Water Protection and Wastewater Management (L2008)	Project Seminar	3	3

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	• Basic knowledge in water management; • Good knowledge in urban drainage; • Good knowledge of wastewater treatment techniques; • Good knowledge of pollutants (e.g. COD, BOD, TS, N, P) and their properties;
Educational Objectives	After taking part successfully, students have reached the following learning results
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 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	
Social Competence	The students can work together in international groups.
Autonomy	Students are able to organize their work flow to prepare presentations and discussions. They can acquire appropriate knowledge by making enquiries independently.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Presentation
Examination duration and scale	Term paper plus 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: 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 Water and Environmental Engineering: Specialisation Environment: Compulsory

Course L0226: Water Protection and Wastewater Management	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	The lecture focusses on: • 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	
Typ	Project Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Ralf Otterpohl
Language	EN
Cycle	WiSe
Content	
Literature	

Module M0802: Membrane Technology

Courses

Title	Typ	Hrs/wk	CP
Membrane Technology (L0399)	Lecture	2	3
Membrane Technology (L0400)	Recitation Section (small)	1	2
Membrane Technology (L0401)	Practical Course	1	1

Module Responsible	Prof. Mathias Ernst
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge of water chemistry. Knowledge of the core processes involved in water, gas and steam treatment
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students will be able to rank the technical applications of industrially important membrane processes. They will be able to explain the different driving forces behind existing membrane separation processes. Students will be able to name materials used in membrane filtration and their advantages and disadvantages. Students will be able to explain the key differences in the use of membranes in water, other liquid media, gases and in liquid/gas mixtures.
Skills	Students will be able to prepare mathematical equations for material transport in porous and solution-diffusion membranes and calculate key parameters in the membrane separation process. They will be able to handle technical membrane processes using available boundary data and provide recommendations for the sequence of different treatment processes. Through their own experiments, students will be able to classify the separation efficiency, filtration characteristics and application of different membrane materials. Students will be able to characterise the formation of the fouling layer in different waters and apply technical measures to control this.
Personal Competence	
Social Competence	Students will be able to work in diverse teams on tasks in the field of membrane technology. They will be able to make decisions within their group on laboratory experiments to be undertaken jointly and present these to others.
Autonomy	Students will be in a position to solve homework on the topic of membrane technology independently. They will be capable of finding creative solutions to technical questions.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following Curricula	Civil Engineering: Specialisation Water and Traffic: Elective Compulsory Bioprocess Engineering: Specialisation A - General Bioprocess Engineering: Elective Compulsory Bioprocess Engineering: Specialisation B - Industrial Bioprocess Engineering: Elective Compulsory Chemical and Bioprocess Engineering: Specialisation Chemical Process 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 Joint European Master in Environmental Studies - Cities and Sustainability: Specialisation Water: Elective Compulsory Process Engineering: Specialisation Process Engineering: Elective Compulsory Process Engineering: Specialisation Environmental 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: Membrane Technology	
Typ	Lecture
Hrs/wk	2
CP	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	
Typ	Recitation Section (small)
Hrs/wk	1
CP	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	
Typ	Practical Course
Hrs/wk	1
CP	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

Module M1505: Adaptation to Climate Change in Hydraulic Engineering (AKWAS)

Courses

Title	Typ	Hrs/wk	CP
Adaptation to climate change in hydraulic engineering (L2291)	Project-/problem-based Learning	4	6

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	• Hydrology, Hydraulic Engineering • Hydromechanic, Hydraulics • Fundamentals of Coastal Engineering, Coastal- and Flood Protection • Hydrological Systems
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	• Climate protection and climate adaptation • Insights into climate change and its regional characteristics - fundamentals, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle • Fundamentals of analysis of climate data • Consequences of the impact of the climate change • Measures for climate adaptation • Assessment, prioritization and communication of adaptation measures • Fundamentals of the analysis of hydrometeorological and hydrological data
Skills	• Critical thinking: analysis of processes and relations, assessment of needs for action • Creative thinking: development of adaptation strategies and adaptation measures • Practical thinking: inclusion of restrictions, application of calculation approaches, methods, numerical models, planning methods • Consideration of complex tasks
Personal Competence	
Social Competence	• Working in heterogenous groups • Working with different scientific / non-scientific disciplines • Self reflection
Autonomy	• Application oriented use of knowledge and skills • Autonomous work on complex tasks
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Course achievement	None
Examination	Written elaboration
Examination duration and scale	Preparation of a written report and a presentation of a complex task.
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 Water and Environmental Engineering: Specialisation Cities: Elective Compulsory Water and Environmental Engineering: Specialisation Environment: Elective Compulsory Water and Environmental Engineering: Specialisation Water: Elective Compulsory

Course L2291: Adaptation to climate change in hydraulic engineering	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	• Climate protection and climate adaptation • Findings on climate change and its regional characteristics: fundamentals of climate change, climate modelling / climate models • Impacts of climate change on the components of the regional hydrological cycle(climate science view) • Fundamentals of the analysis of climate data • Concequences of the impacts of climate change (ingenieering science view) • Measures for climate change adaptation • Assessment, prioritization and communication of measures • Fundamentals of analysis of hydrometeorological and hydrological data
Literature	• Bereitgestellte eLearning Plattform

Thesis

Module M-002: Master Thesis

Courses			
Title	**Typ**	**Hrs/wk**	**CP**

Module Responsible	Professoren der TUHH
Admission Requirements	• According to General Regulations §21 (1): At least 60 credit points have to be achieved in study programme. The examinations board decides on exceptions.
Recommended Previous Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	• 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	The students are able: • 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	Students can • Both in writing and orally outline a scientific issue for an expert audience accurately, understandably and in a structured way. • Deal with issues competently in an expert discussion and answer them in a manner that is appropriate to the addressees while upholding their own assessments and viewpoints convincingly.
Autonomy	Students are able: • To structure a project of their own in work packages and to work them off accordingly. • To work their way in depth into a largely unknown subject and to access the 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
Course achievement	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 Aircraft Systems Engineering: Thesis: Compulsory Global Innovation Management: Thesis: Compulsory Computational Science and Engineering: Thesis: Compulsory Information and Communication Systems: 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

	Mechatronics: Thesis: Compulsory Biomedical 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 Teilstudiengang Lehramt Metalltechnik: Thesis: Compulsory Theoretical Mechanical Engineering: Thesis: Compulsory Process Engineering: Thesis: Compulsory Water and Environmental Engineering: Thesis: Compulsory Certification in Engineering & Advisory in Aviation: Thesis: Compulsory