Description of the degree program

Environmental Engineering (Bachelor)
PO 5

Date: 19.01.2026

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Basics of Mathematics and Natural Sciences

Title	Mathematics for Engineers A		
Number	1294250	**Module version**	V2
Shorttext	MAT-STD7-25	**Language**	english german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Partielle Differentialgleichungen
Hours per Week / ECTS	6 / 8,0	**Module owner**	Studiendekan der Mathematik
Workload (h)	240		
Class attendance (h)	112	**Self studying (h)**	128
Compulsory requirements			
Expected performance/ Type of examination	1 written exam (180 minutes) After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination.		
Course achievement			

Contents

Mathematics for engineering students A (Calculus 1)
1 sequences and limit: definitions and concepts, e.g. monotony and bounds, convergence criteria of comparison and of monotony, typical limits, Euler's number e, accumulation point, limit superior, Bachmann-Landau notation, supremum, Cauchy sequence, basic properties of real numbers
2 series: convergence and absolute convergence, geometric, harmonic and exponential series, comparison test, ratio test, root test, alternating series test with proofs
3 functions: concepts, standard functions including hyperbolic and area functions, relation to trigonometric functions, inverse function, rational functions and partial fraction decomposition, graphical representation
4 limits of functions and continuity: definition, properties of continuous functions, classification of discontinuities, intermediate value theorem, extreme value theorem with proof
5 differentiation: difference and differential quotient, C^n-spaces and norms, product and chain rule, derivatives of standard functions, derivatives of inverse functions, mean value theorem, de l'Hospital's rule with proof, extreme values, curvature Taylor polynomials and series
6 integration: definit and indefinit integral (Riemann), fundamental theorem of calculus with proof, integration by parts, integration by substitution, integrals of standard functions, integrals of rational functions and power series, improper integrals, Gamma-unction

Mathematics for engineering students A (Linear Algebra)
1 algebraic structures: number domains, group, field, modulo, complex numbers, cartesian and polar form, Euler's identity, roots of complex numbers, polynomial division, linear factor decomposition, fundamental theorem of algebra without proof
2 vectors and vector spaces: linear independence, sub-space, basis, dimension, norm, scalar product, projection, ortho-normal basis, Cauchy Schwarz inequality
3 linear maps and matrices: definition of general linear maps, kernel, image, rank, inverse matrix, transposition, determinant, matrix norm
4 Gaussian algorithm: trapezoid form, underdetermined systems and parameter-dependent solutions, inverse matrix
5 eigenvalues and eigenvectors: diagonalizable matrices, eigenvalues and -vectors of symmetric matrices, Jordan form, similarity

6 vectors in geometry: lines and planes, Hesse normal form, vector product, triple product, transformation of coordinates

Objective qualification

The students combine the learnt mathematical methods of univariate calculus and linear algebra in the description and investigation of applied problems in the engineering
sciences. They choose appropriate calculation techniques and appropriate methods of proof for the discussion of the mathematical fundamentals in the applied and engineering sciences,
and they apply these techniques and methods. The students explain the formation of mathematical concepts and they derive the motivation of these concepts from applications and from the mathematical specification and delimitation of terms and definitions. The students reproduce and explain basic proofs and ideas of proofs in univariate calculus and linear algebra. They are able to identify and to test relations between the learnt concepts. The students are able to analyse mathematical problems occurring in applications and engineering lectures,
to extract and to solve treatable sub-problems and to identify continuative difficulties. Finally, students use constructively modern tools for the treatment of computational problems.

Literature

Text books and lecture notes on calculus, linear algebra, mathematics for engineers, e.g.
* Burg, Haf, Wille, Meister: Höhere Mathematik für Ingenieure, Band I & II, SpringerVieweg
* Ansorge, Oberle, Rothe, Sonar: Mathematik in den Ingenieur- und Naturwissenschaften, Band I, Wiley
* Langemann, Sommer: So einfach ist Mathematik, zwölf Herausforderungen im ersten Semester, SpringerSpektrum

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Related courses

Rules for the choice of courses

You can attend lectures in German or English.
Participation in the small exercises is voluntary.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Mathematics for Engineers A (Analysis 1)	1,0	Exercise	german
Mathematics for Engineers A (Analysis 1)	1,0	Exercise, small group	german
	2,0	Lecture/Exercise	german
	1,0	Exercise, small group	german
	2,0	Lecture/Exercise	english
	1,0	Exercise	english
	1,0	Exercise, small group	english
	2,0	Lecture/Exercise	english
	1,0	Exercise	english

	1,0	Exercise, small group	english
Mathematics for Engineers A (Linear Algebra)	1,0	Exercise	german
Mathematics for Engineers A (Linear Algebra)	2,0	Lecture/Exercise	german
Mathematics for Engineers	6,0	Lecture/Exercise	english german

Title	Engineering Mathematics and -Programming		
Number	4310570	**Module version**	
Shorttext	BAU-STD4-5	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für rechnergestützte Modellierung im Bauingenieurwesen
Hours per Week / ECTS	7 / 8,0	**Module owner**	Prof. Dr. Manfred Krafczyk
Workload (h)	240		
Class attendance (h)	98	**Self studying (h)**	142
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

[Einführung in die Programmierung (VÜ)]
Motivation and teaching of basic concepts of object-oriented programming: data encapsulation, class concept, inheritance, polymorphism, containers, introduction to an object-oriented programming language, control structures, input/output, simple graphics programming.

[Einführung in die Programmierung (T)]
Motivation and teaching of basic concepts of object-oriented programming: data encapsulation, class concept, inheritance, polymorphism, containers, introduction to an object-oriented programming language, control structures, input/output, simple graphics programming.

[Ingenieurmathematik B (Differentialgleichungen) (V)]
1- differential equations: conversion into systems of first order, slope field, modeling e.g. of an oscillator, solving ODEs with Mathematica and Matlab, GNU-Octave, Wolfram Alpha or Python
2- simple solution procedures: separation of variables, ODEs in homogeneous variables, linear ODEs of first order, homogeneous and particular solution, variation transient and steady state, exact ODEs and integrating factor
3- existence and uniqueness: Peano existence theorem, Lipschitz continuity, Picard Lindelöf theorem
4- linear ODEs of n-th order: superposition principle, fundamental system, Wronski determinant and linear independence of solutions, variation of parameters
5- linear ODEs with constant coefficients: e-ansatz, harmonic oscillator, strongly and weakly damped oscillations, aperiodic limit case, system response to extrenal excitations including its derivation, resonance
6- systems of linear ODEs: e-ansatz, variation of constants, matrix notation
7- Laplace transform: properties of multiplication, derivative and damping, solving ODEs by Laplace transform discontinuous right-hand sides, Diracs delta-distribution and impact
8- boundary value problems: deformation of a string, Green's function
9- dynamical systems: Lotka-Volterra equations, phase plot, stationary, stable and asymptotically stable points

Objective qualification
Literature
Lecture script

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Mathematics for Engineers B (Differential Equations)	2,0	Lecture/Exercise	german
Mathematics for Engineers B (Differential Equations)	1,0	Exercise	german
Mathematics for Engineers B (Differential Equations)	1,0	Exercise, small group	german
	2,0	Lecture/Exercise	german
	1,0	Tutorial	german

Title	Chemistry for Environmental Engineering		
Number	4310470	**Module version**	
Shorttext	BAU-STD4-4	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	2	**Institution**	Institut für Siedlungswasserwirtschaft
Hours per Week / ECTS	5 / 7,0	**Module owner**	Prof. Dr. Thomas Dockhorn
Workload (h)	210		
Class attendance (h)	70	**Self studying (h)**	140
Compulsory requirements			
Expected performance/ Type of examination	Written exam Inorganic Chemistry (120 Min.) Written exam Water Chemistry and Water Analytics (60 Min.)		
Course achievement			

Contents

[Water Chemistry and Water Analytics (VÜ)]
The class covers basics of organic chemistry, characteristics of water, calculation and application examples for solubility and precipitation reactions, acid base equilibrium, sampling and sample preparation for environmental engineering questions, special chemical parameters for water and wastewater (sum parameters, rapid testing, standard analytics) and special instruments for water analytics (atomic absorption spectrometry, mass spectrometry, chromatography).

[Inorganic Chemistry (V+Ü)]
The class presents basics of structure of atoms and periodic table of elements, chemistry of main group elements and selected other elements, introduction to types of chemical bonds and aggregate states, stoichiometry of chemical reactions, fundamentals of thermodynamics and kinetics, determination of oxidation states and forming of redox reactions as well as fundamentals of electrochemistry.

Objective qualification

Students will gain essential knowledge of general and inorganic chemistry and relevant problems in water chemistry. They will be able to understand the fundamental behavior of chemical elements and compounds, to solve stoiciometric calculations, to understand biochemical and chemical problems in water and wastewater treatment and find solutions for these problems

Literature

Comprehensive lecture notes for ‘Water Chemistry and Water Analytics’ are available for download. Power point presentations for ‘Water Chemistry’ are also available for download. Technical literature and additional information is presented during the class.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	1,0	Exercise	german
Water Chemistry and Water Analytics	2,0	Lecture/Exercise	german

Title	Numerical Methods in Engineering		
Number	4310510	**Module version**	
Shorttext	BAU-STD4-5	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für rechnergestützte Modellierung im Bauingenieurwesen
Hours per Week / ECTS	4 / 4,0	**Module owner**	Prof. Dr. Martin Geier
Workload (h)	120		
Class attendance (h)	56	**Self studying (h)**	64
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement			
Contents			
Interpolation methods, numerical differentiation, numerical integration, ordinary differential equations and time integration methods, non-linear equations, Fourier series, Richardson-extrapolation, empirical order of convergence			
Objective qualification			
The students acquire a basic knowledge on numerical methods in engineering and are able to find solutions to problems in engineering using numerical methods.			
Literature			
Gekeler: Mathematische Methoden zur Mechanik, Springer			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	2,0	Exercise	german
	2,0	Tutorial	german

Title	Ecology		
Number	3328100000	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Abteilung für Landschaftsökologie und Umweltsystemanalyse
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Frank Suhling
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90min)		
Course achievement			

Contents

[Geoecology (V)]
Fundamentals of soil science - soil functions - mineral and organic soil substrate - processes of soil formation - properties of soils depending on soil type - water, air and heat balance of soils.
Fundamentals of climatology: structure and composition of the atmosphere - Radiation, heat and water budget/balance; surface-atmosphere exchange – The atmosphere in motion: micro-, meso- and macroscale circulation regimes.
Fundamentals in groundwater and surface water chemistry, thermodynamics of weathering, Gases in water/carbonate equilibrium reactions, important redox-reaction in natural systems, biogeochemical cycling.
[Ecology (V)]
Characteristics of organisms - Organisms and their environment - Population ecology - Dispersal, migration and introduction of alien species - Evolutionary mechanisms - Interactions: Competition, predation, mutualism and parasitism - Ecosystem function and dynamics terrestrial, limnetic, marine and urban ecosystems - Global ecosystem transformation.

Objective qualification

After successful completion of the module, students have a basic understanding of abiotic and biotic relationships and interactions as well as geoecological functions and processes in the compartments atmosphere, biosphere, hydrosphere and pedosphere.
Through the lecture Fundamentals of Geoecology they gain basic knowledge of the soil, water and atmosphere compartments in the geosystem.
After completing the lecture Ecology for Environmental Scientists, they have basic knowledge of the processes and mechanisms of ecology of organisms, populations, communities, habitats and important biomes, as well as specific problems of conservation and global change. As a result, they are able to understand the ecological processes that influence biological communities and assess the importance of ecological processes for environmental planning.

Literature

Nentwig, W., Bacher, S., & Brandl, R. (2011). Ökologie kompakt. Heidelberg: Spektrum Akademischer Verlag.
-Begon, M., Howarth, R. W., & Townsend, C. R. (2016). Ökologie. Springer-Verlag. Beides als E-Book vorhanden

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	2,0	Lecture	german

Title	Environmental Systems Analysis		
Number	3328100010	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Abteilung für Landschaftsökologie und Umweltsystemanalyse
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Frank Suhling
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (60min)		
Course achievement			

Contents

[Environmental Systems Analysis (V+Ü)]
Fundamentals of modeling of environmental processes - Digital terrain analysis - Classification and regression trees - Linear compartmental models - Models of complex nonlinear systems - Methods of system analysis: stability, attractors in phase space, chaotic behavior, sensitivity analysis - Development of own models, use of freely available programs like R (cran.r-project.org) and SAGA.

Objective qualification

Through the lecture and exercise Environmental Systems Analysis, they are able to design conceptual models of environmental systems and translate them into mathematical models with the goal of a deeper understanding of their dynamics. They will be able to use case studies to understand impacts of human actions on ecological processes and the consequences for society.

Literature

-Imboden DM, Koch S. (2003). Systemanalyse : Einführung in die mathematische Modellierung natürlicher Systeme.
Springer.
-Matthiopoulos J. (2011). How to be a quantitative ecologist. Wiley,

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**

	2,0	Lecture	german
	2,0	Exercise	german

Title	Environmental Protection		
Number	4337060	**Module version**	
Shorttext	BAU-SWS-06	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Siedlungswasserwirtschaft
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Thomas Dockhorn
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

[Environmental Protection for Engineers (V)]
Basics of biological, chemical and physical treatment processes for water, wastewater, exhaust air and solid waste, basics of ecology, fundamentals of energy management, basic environmental legislation (national), principles of international environmental law, introduction to environmental guidelines and sustainability

[Geology for Engineers (V)]
Introduction to formation and structure of earth, plate boundary processes, the geological concept of the rock cycle, basics of the geological time scale, introduction to endogenic and exogenic processes and their impact on landscape and land use.

Objective qualification

Students will gain essential knowledge of fundamental biological, physical and chemical processes, required for accomplishing environmental protection. In addition, they will acquire necessary knowledge of ecological, economic, social and political correlations to understand the engineers' responsibilities in the field of environmental protection. They will be able to derive engineering solutions for environmental problems. Students will also gain knowledge of the essential geological processes, which determine the features that constitute earth's surface, the geologic history and structure of earth. They will acquire skills to classify and differentiate natural and anthropogenic processes. Students will be able to develop and optimize engineering solutions for environmental and geological problems.

Literature

Power point presentations for both classes are available for download

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Environmental Protection for Engineers	2,0	Lecture	german
	2,0	Lecture	german

Title	Physics I for Environmental Sciences and Engineers		
Number	1521050	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration		**Institution**	
Hours per Week / ECTS	3 / 4,0	**Module owner**	
Workload (h)	120		
Class attendance (h)	72	**Self studying (h)**	48
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90min)		
Course achievement			

Contents

Knowledge of physical quantities and units, kinematics and dynamics, including energy, momentum, circular motion, liquids and gases, including pressure and properties of flowing liquids. Thermodynamics, including heat transport, states of matter, gas law and the laws of thermodynamics.

Objective qualification

Students learn the physical principles of mechanics and thermodynamics, which are required to understand the processes in the Earth's interior and to develop methods for recording and dealing with environmentally relevant issues.
This includes: Physical quantities and units, kinematics and dynamics, including energy, momentum, circular motion, fluids and gases, including pressure and properties of flowing fluids. Thermodynamics, including heat transport, states of matter, gas law and the laws of thermodynamics.

Literature

Will be announced in the course.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**

		Lecture/Exercise	german

		Lecture/Exercise	german

Physics I for Environmental Scientists and Environmental Engineers	2,0	Lecture	german
Literature			
Ulrich Haas, Physik für Pharmazeuten und Mediziner, 6. Auflage, ISBN 3-8047-1823-X Trautwein, Kreibig, Hüttermann, Physik für Mediziner, Biologen, Pharmazeuten, 7. Auflage, ISBN 978-3-11-019792-1			

Physics I for Environmental Scientists and Environmental Engineers	1,0	Exercise	german
Literature			
Ulrich Haas, Physik für Pharmazeuten und Mediziner, 6. Auflage, ISBN 3-8047-1823-X Trautwein, Kreibig, Hüttermann, Physik für Mediziner, Biologen, Pharmazeuten, 7. Auflage, ISBN 978-3-11-019792-1			

Basics of Engineering

Title	Technical Mechanics 1		
Number	3315000000	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Angewandte Mechanik
Hours per Week / ECTS	5 / 5,0	**Module owner**	Prof. Dr. Ralf Jänicke
Workload (h)	150		
Class attendance (h)	70	**Self studying (h)**	80
Compulsory requirements			
Expected performance/ Type of examination	3 written exams (45 min. each), during the semester		
Course achievement			
Module grade composition	The module grade is calculated from the average of the three written examinations; examinations graded as "non sufficient" can be compensated by better graded examinations.		

Contents
This course deal with the statics of rigid structures: forces and torques, static equilibrium and determinacy, center of gravity, supports and joints, truss structures, internal forces in beams and frames, adhesion and friction.
Objective qualification
Completion of this course enables students to determine internal and external forces and torques in two- and three-dimensional, rigid, load-bearing structures, even in presence of Coulomb friction.
Literature
(1) Gross, Hauger, Schell, Schröder: Technische Mechanik 1: Statik, Springer (2) Hartmann: Technische Mechanik, Wiley (3) Hibbeler: Technische Mechanik 1: Statik, Pearson

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Related courses
Rules for the choice of courses
Compulsory attendance

Name of the course	**SWS**	**Eventtype**	**Language**

	5,0	Lecture/Exercise	german
	2,0	Tutorial	german

Title	Technical Mechanics 2		
Number	3315000010	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Angewandte Mechanik
Hours per Week / ECTS	5 / 5,0	**Module owner**	Prof. Dr. Ralf Jänicke
Workload (h)	150		
Class attendance (h)	70	**Self studying (h)**	80
Compulsory requirements			
Expected performance/ Type of examination	3 written exams (45 min. each), during the semester		
Course achievement			
Module grade composition	The module grade is calculated from the average of the three written examinations; examinations graded as "non sufficient" can be compensated by better graded examinations.		

Contents

This course extends the “engineering mechanics 1” course to the statics of deformable bodies: tension and compression of trusses, state of stress and strain, linear elasticity, bending of beams, torsion and buckling.

Objective qualification

Completion of this course enables students to determine internal and external forces and torques in two- and three-dimensional, elastic, load-bearing structures. They are familiar with the basics of strain, stress, and constitutive relations and can consequently predict deformation of trusses, bars and other simple structures under external loading. They can solve geometrically non-linear problems using the example of buckling.

Literature

(1) Gross, Hauger, Schröder, Wall: Technische Mechanik 2: Elastostatik, Springer
(2) Hartmann: Technische Mechanik, Wiley
(3) Hibbeler: Technische Mechanik 2: Festigkeitslehre, Pearson

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**

	5,0	Lecture/Exercise	german
	2,0	Tutorial	german

Title	Hydromechanics		
Number	4320010	**Module version**	
Shorttext	BAU-STD3-4	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Abteilung Hydromechanik, Küsteningenieurwesen und Seebau
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Nils Goseberg
Workload (h)	180		
Class attendance (h)	70	**Self studying (h)**	110
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

[Hydromechanics (V+Ü)]
Tasks of hydromechanics and mechanical properties of water, hydrostatics, introduction to hydrodynamics, continuity equation, introduction to potential flow, energy and momentum theorems, combined applications of conservation laws, theory of critical water depth, surge and sunk waves, Borda´s shock loss and hydraulic jump. Introduction to real fluids, fluid friction law of NEWTON, laminar and turbulent flows, boundary layer concept of PRANDTL, laminar flow in circular pipe and in the ground, turbulent flow in circular pipe and in open channel flow.

Objective qualification

Upon completion of the module, students will be able to solve the conventional problems in practice with the help of the acquired basics of hydromechanics and quickly acquire the complementary knowledge for solving special flow problems. At the beginning, students are given an understanding of the basic laws/concepts of hydrostatics and fluid mechanics and their practical implications in civil and environmental engineering. The basic law of hydrostatics essentially addresses the determination of level surfaces and of hydrostatic forces on adjacent surfaces of any shape under the action of the earth's and other accelerations, as well as the demonstration of the buoyancy and stability of bodies. Idealized fluid mechanics involves the application of the conservation laws of mass, energy, and momentum and their various combinations to solve complex flow problems analytically. Furthermore, students learn how an ideal flow is changed by introducing viscosity and how this results in real flows considering viscosity. Using the examples of laminar pressure flows in circular pipes and in the ground, and turbulent pressure pipe and free-flow flows, students will learn about the complexity of real, frictional flows compared to ideal, frictionless flows. The limitations of the theoretical approaches derived will be demonstrated using practical examples

Literature

Detailed Hydromechanics script of approximately 297 pages, PowerPoint lecture presentations with educational videos about hydromechanics.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	5,0	Lecture/Exercise	german

Title	Materials Science for Civil Engineering		
Number	4398400	**Module version**	
Shorttext	BAU-STD3-6	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	2	**Institution**	Fachgebiet Baustoffe
Hours per Week / ECTS	8 / 8,0	**Module owner**	Prof. Dr. Dirk Lowke
Workload (h)	240		
Class attendance (h)	112	**Self studying (h)**	128
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
-Übungsunterlagen -ausführliches Vorlesungsmanuskript			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german
	4,0	Lecture/Exercise	german

Title	Total Life-Cycle-Management		
Number	2522990	**Module version**	v2
Shorttext	MB-IWF-99	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	1 examination element: written exam+ (120 min) or oral exam+ (30 min)		
Course achievement	1 course achievement: presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.)		
Module grade composition	(On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.		

Contents

- central challenges and relations between global economic and ecological developments
- meaning and background of the concept of sustainability and resulting consequences for companies
- existing life cycle concepts and appropriate life cycles of technical products
- reference Framework for Total Life Cycle Management
- complex systems in the context of life cycle management methods
- engineering methods for the analysis and quantification of ecological and economic impacts
- Sensitization for problem shifts
- simulation-based business game for holistic thinking (team project)

Objective qualification

Students…

- can spot and identify relevant challenges and interrelationships between global economic and ecological developments and place them within the framework of reference of Total Life Cycle Management.
- can name the central elements of sustainable development and analyse them with the help of the framework.
- are able to analyse life cycle oriented concepts in order to develop sustainable life cycles of technical products.
- are able to think in complex dynamic systems and to outline the model of viable systems.
- are able to distinguish between life-phase and life-cycle related disciplines and to discuss them with the help of the St. Gallen management concept and the framework of Total Life Cycle Management.
- are able to reproduce the procedure of a life cycle assessment, naming the framework conditions (e.g. environmental impact, functional unit) and discuss the results of a life cycle assessment.
- are able to independently carry out an economic impact analysis using the Life Cycle Costing method.
- are able to organise themselves effectively within group work, to divide the work, to ensure that goals are achieved on time and to use solution-oriented communication.

Literature

1. HERRMANN, Christoph. Ganzheitliches Life Cycle Management. Springer, 2009.

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Related courses			
Rules for the choice of courses			
Lecture and excercise have to be attended			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Total Life-Cycle-Management	2,0	Lecture	german
Total Life-Cycle-Management	1,0	Team Project	german

Title	Geodesy and Geographical Information		
Number	4306660	**Module version**	
Shorttext	BAU-STD3-6	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Geodäsie und Photogrammetrie
Hours per Week / ECTS	6 / 6,0	**Module owner**	Prof. Dr. Markus Gerke
Workload (h)	180		
Class attendance (h)	84	**Self studying (h)**	96
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement	Term paper		

Contents

[Geodesy (LE)]
Large-scale coordinate systems, basic knowledge of geodetic measurement and evaluation methods, satellite positioning, remote sensing, laser scanning, photogrammetry, solution approaches for typical surveying tasks, solution competence for simple surveying tasks, basics of statistics and error theory.

[Geographic Information Systems (LE)]
Fundamentals of spatial data modeling and processing, working with ESRI's ArcGIS, presentation techniques.

Objective qualification

The students learn the essential basics from geodesy and geoinformation. This includes coordinate systems, measurement systems for three-dimensional and continuous data acquisition, as well as the practical use of sensors and the associated evaluation algorithms (Geodesy). In the course Geoinformation knowledge is imparted on the theory, practical structure and use of Geographic Information Systems (GIS). The students will be able to apply the essential methods and algorithms from geodesy and Geoinformation to problems in civil and environmental engineering.

Literature

Witte, Schmidt (2005): Vermessungskunde und Grundl. Statistik für das Bauwesen, Resnik, Bill (2003): Vermessungskunde für den Planungs-, Bau- und Umweltbereich, Kahmen (1997): Vermessungskunde; b) Selbstentwickelte multimediale GIS-Lernmodule, Lange, N. de (2002): Geoinformatik in Theorie und Praxis.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture/Exercise	german
	1,0	Exercise	german
	2,0	Lecture	german
	1,0	Practical exercise	german

Title	Hydrology and Hydrogeology		
Number	4336010	**Module version**	
Shorttext	BAU-STD2-6	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Abteilung Hydrologie und Flussgebietsmanagement
Hours per Week / ECTS	4 / 4,0	**Module owner**	Prof. Dr. Kai Schröter
Workload (h)	120		
Class attendance (h)	56	**Self studying (h)**	64
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
wird in der Vorlesung bekannt gegeben			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german

Subject-specific Area Water Resources Management

Title	Hydraulic Engineering and Water Resources Management		
Number	4320140	**Module version**	
Shorttext	BAU-STD3-7	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Abteilung Wasserbau und Gewässermorphologie
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Jochen Aberle
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

[Water Management (VÜ)]
Tasks of hydrology and water management; water cycle and water balance of catchment areas; measurement and processing of hydrometeorological data; physical-mathematical models for rainfall-runoff processes; hydrological design of dams; reservoir management; exercises

[Hydraulic Engineering (VÜ)]
Introduction to river science; water level and water surface profile calculation; river training measures; hydraulic structures (weirs, dams; stilling basins); environmental hydraulics; sediment transport; river revitalization; ecological connectivity of rivers; hydropower structures

Objective qualification

The students acquire a basic knowledge of engineering hydrology principles and water management in connection with hydraulic engineering principles and environmentally relevant natural sciences (meteorology, biology, geology, etc.). From a hydrological point of view, the basics of physical-mathematical models are presented so that the students will be able to evaluate hydro-meteorological measurement series of river catchment areas and to establish water balances. Moreover, the students will learn the design principles for water storage structures considering flooding and reservoir management.
From a hydraulic engineering point of view, the students will learn the basic principles for the design and dimensioning of hydraulic structures including dams, weirs, and nature-based solutions. They will be able to calculate open-channel water surface profiles, the conveyance capacity of hydraulic structures, and will acquire the basic knowledge to assess the morphological development of rivers and streams so that they will have the basic understanding to plan and implement hydraulic engineering measures and hydraulic structures.

Literature

Es stehen ein Skript und PC-Arbeitshilfen (Programme, Spreadsheets) zur Verfügung.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture/Exercise	german
	2,0	Lecture/Exercise	german

Title	Water Management		
Number	4399590	**Module version**	
Shorttext	BAU-STD-31	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	2	**Institution**	Abteilung Hydrologie und Flussgebietsmanagement
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Kai Schröter
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Skripte			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture/Exercise	german
	2,0	Lecture/Exercise	german

Title	Hydraulic Engineering - Application		
Number	4306790	**Module version**	
Shorttext	BAU-STD3-79	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Abteilung Wasserbau und Gewässermorphologie
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Jochen Aberle
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (60 Min.)		
Course achievement	Term paper		

Contents

Lecture: Methods and procedures for flood risk assessment an integrated flood risk management; area-detailed and GIS-based precipitation-runoff modelling; statistical analysis of time-series data and methods of extreme value statistics, approaches for the design of flood protection measures and risk based assessment.
Fields of application of 1-D programs, theoretical basics of 1-D water level calculation, practical use of a program: model setup by input of geometry and roughness, calibration of the model, variation of input parameters, installation of hydraulic structures such as bridges and weirs, interpretation of results.
Seminar: A wide range of topics from the fields of hydraulic engineering, hydrology, water management and water protection as well as hydromechanics and coastal engineering are addressed every semester. Interdisciplinary connections with natural sciences, economics and social sciences and structural engineering are also highlighted.

Objective qualification

The students gain insights into the principles of flood risk assessment and management and are able to explain the driving factors of flood risk. They gain the capability to select and evaluate different flood risk prevention options including natural and technical flood protection measures. They acquire the ability to conduct statistical extreme value analysis and to use these information for the design of flood protection measures and the assessment of flood risk.

The students acquire the ability to carry out and interpret computer-aided 1-D water level calculations. They will acquire the theoretical basics for the calculations so that the results can be correctly interpreted and the strengths and weaknesses of the software can be recognized.

The hydraulic engineering seminar gives students an insight into professional practice and the different fields of activity in hydraulic engineering, water management and coastal engineering through lectures by guest speakers working in administrative institutions, engineering offices, water associations or construction companies.

The students acquire the ability to professionally process a hydraulic engineering as well as water management issue using specific literature to deepen the basic knowledge they have learned.

Literature
Ausgabe von Vorlesungsunterlagen, Übungsaufgaben und Lernhilfen

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Compulsory attendance in Wasserbauseminar			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Seminar	german
	2,0	Lecture	german

Subject-specific Area Energy Technology

Title	Fundamentals of Energy Engineering		
Number	2520350	**Module version**	
Shorttext	MB-WuB-35	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Daniel Schröder
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	1 examination element: written exam (120 min) or oral exam (30 min)		
Course achievement			

Contents

Lecture
- Types of energy and technical ways of energy conversion
- Energy sources and energy storages
- Balancing of energy conversion processes
- Chemical and electrochemical energy conversion (combustion, gasification, fuel cells, batteries)
- Thermal energy conversion (heat transfer, geothermal energy conversion and solar thermal energy conversion)
- Mechanical energy conversion (compression/expansion, water and wind energy)
- Physical energy conversion (photovoltaic, thermoelectric, and nuclear energy conversion)
- Energy systems and cyclic processes (conventional and renewable energy systems)

Exercise:
Exercises cover examples from energy storage and conversion, and heat and mass balances of processes.

Objective qualification

The students can state and explain different forms of energy as well as renewable and fossil energy sources. They can describe the principle of operation of common energy conversion technologies. In addition, they are able to independently develop and apply balanced equations for energy processes. Based on this, the students can analyze processes that allow the conversion of physical, chemical, mechanical and thermal forms of energy and evaluate them based on their efficiency. Furthermore, the students can describe the interconnection of typical energy systems using flow diagrams. The students are able to select suitable energy converters depending on the problem and plan an interconnection to energy systems or power plants.

Literature

1. S. Skogestad, Chemical and energy engineering, 2008, CRC Press
2. H. Watter, Nachhaltige Energiesysteme, 2011, Vieweg-Teubner
3. N. Khartchenko, Umweltschonende Energietechnik, 1997, Vogel

4. Umdruck zur Vorlesung

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Fundamentals of Energy Engineering	2,0	Lecture	german
Fundamentals of Energy Engineering	1,0	Exercise	german

Title	Basics of electrical power engineering for transportation and environmental engineering		
Number	2423610	**Module version**	
Shorttext	ET-HTEE-61	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	**Institution**	
Hours per Week / ECTS	6 / 7,0	**Module owner**	Prof. Dr. Michael Kurrat
Workload (h)	210		
Class attendance (h)	84	**Self studying (h)**	126
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Teil 1: Grundlagen der Energieversorgung Elektrische Energieversorgung, K. Heuck, Vieweg Verlag Elektrische Energieverteilung, R. Flosdorff, Teubner Verlag Teil 2: Grundlagen der elektromechanischen Energieumformung R. Fischer, Elektrische Maschinen, Hanser W. Hofmann, Elektrische Maschinen, Pearson E. Spring, Elektrische Maschinen, Springer,			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Seminar	german

	2,0	Lecture	german
	2,0	Exercise	german

Subject-specific Area Process Engineering

Title	Basics of Solids Process Engineering		
Number	2521310	**Module version**	
Shorttext	MB-IPAT-02	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	2	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Arno Kwade
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Recommended requirements	Basic mathematical and mechanical knowledge		
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)		
Course achievement	1 course achievement: colloquium and report on the completed laboratory experiments		

Contents

Lecture: Definition and areas of application (including nanotechnology), particle and product properties of disperse systems, forces on particles in flowing media, flow through packings, visualisation of particle size distributions, particle size analysis, mechanical separation processes (classification, sorting, separation), mixing, comminution (particle stress, particle breakage, overview of machines), agglomeration (adhesion mechanisms, processes)

Exercise: Using selected calculation examples, students should apply and discuss the knowledge they have acquired in the lecture and solve problems independently and present the results in homework assignments.

Practical course: In the practical course accompanying the lecture, students will apply the theoretical principles they have learnt about the four basic operations of mechanical process engineering and particle size analysis in practice. Specifically, the following four experiments are planned: Size reduction and particle size analysis, agglomeration, mixing and shear laboratory.

Objective qualification

After completing this module, students will have basic knowledge of mechanical process engineering, in particular with regard to the characterisation of particles, interaction of particles with fluids and basic operations of mechanical process engineering (mechanical separation processes, mixing, comminution and agglomeration). They will be able to apply the theoretical principles of the four basic operations to practical tasks. Students are able to describe, explain and optimise the behaviour and processing of particles using mechanical processes.

Literature

1. Stieß, Mechanische Verfahrenstechnik 1, Springer-Verlag
2. Stieß, Mechanische Verfahrenstechnik 2, Springer-Verlag
3. Bohnet (Hrsg.), Mechanische Verfahrenstechnik, Wiley-VCH

4. Schubert (Hrsg.), Handbuch der Mechanischen Verfahrenstechnik Band 1 & 2, Wiley-VCH
5. Zogg, Einführung in die Mechanische Verfahrenstechnik, B.G. Teubner Stuttgart
6. Löffler; Raasch, Grundlagen der Mechanischen Verfahrenstechnik, Vieweg
7. Dialer; Onken; Leschonski, Grundzüge der Verfahrenstechnik und Reaktions-technik, Hanser Verlag
8. Ullmann#s Encyclopedia of Industrial Chemistry, VCH Verlagsgesellschaft
9. Vorlesungsskript

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Related courses

Rules for the choice of courses

The course achievement is necessary to complete the module, but is not a prerequisite for participation in the written examination. Of the 4 experiments offered in the practical course, only two must be carried out. The available places are divided between the students.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
	1,0	Exercise	german
	2,0	Internship	german

Title	Unit Operations in Fluid Separations		
Number	2541290	**Module version**	
Shorttext	MB-ICTV-29	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Stephan Scholl
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	1 examination element: written exam (90 min)		
Course achievement	1 course achievement: colloquium or written exam (30 min) and report on the laboratory experiments		

Contents

Lecture: In the lecture Unit Operations in Fluid Separations, the most important fluid separation processes are discussed and explained. In detail these are Crystallisation, Rectification, Absorption, Extraction, Adsorption, Drying

Exercise:
Using selected examples, students learn how to select a suitable unit operation for a given separation problem, how to design the corresponding process and how to design suitable apparatus. The selected examples in the exercises have a strong practical relevance, which is also methodically supported by the use of partly computer-based exercises.

Laboratory:
Phase equilibria and adsorption laboratories must be completed.
The phase equilibrium experiment includes learning how to set up and operate an experimental apparatus, as well as the subsequent sample analysis by means of density determination, and the independent evaluation and assessment of the measurement and calculation results obtained in the form of written documentation. In the adsorption laboratory, students acquire knowledge about adsorption equilibria and adsorption kinetics. They are also able to determine mass transfer coefficients and adsorption isotherms.

Objective qualification

For a given separation problem, students know which thermodynamic pure substance and phase equilibrium information is required to select and design the separation process. Based on this information, they can select a suitable operation and design it in terms of process engineering. They will be familiar with alternative design variants for the realisation of the equipment. Taking into account operational and economic aspects, they will be able to select suitable equipment and dimension it according to requirements. Furthermore, the laboratory enables students to work within a group and communicate efficiently with different target groups. By working with other people (group members, supervisors), students are able to socialise.

Literature

1. Goedecke, Ralf: Fluidverfahrenstechnik Band 1, Weinheim, Wiley-VCH 2006 2. Goedecke, Ralf: Fluidverfahrenstechnik Band 2, Weinheim, Wiley-VCH 2006 3. Mersmann, A.: Thermische Verfahrenstechnik, Verlag Springer, 1980

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Related courses			
Rules for the choice of courses			
The laboratories ‘Phase equilibria’ and ‘Adsorption’ must be taken.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	1,0	Exercise	german
	1,0	Laboratory	german

Subject-specific Area Utility and Waste Management

Title	Water Supply and Wastewater and Waste Management		
Number	4335010	**Module version**	
Shorttext	BAU-STD3-7	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Siedlungs-wasserwirtschaft
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Thomas Dock-horn
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examina-tion	Written exam (120 Min.)		
Course achievement			

Contents

[Recycling and Waste Management (VÜ)]
Collection of wastes, transport systems, biological, chemical and physical treatment processes for solid wastes, waste collection route planning, planning and dimensioning of waste treatment plants, aspects of hygiene, quantity and quality of wastewater and exhaust air from various treatment plants and for various treatment technologies, methods for ecological evaluation of waste treatment technologies, introduction of models for quality control of secondary raw materials

[Water Supply and Wastewater Management (V)]
Basics of drinking water supply, treatment and distribution, basics of wastewater discharge, separate and combined sewer systems, dimensioning and construction of sewer systems, basics of wastewater treat-ment, mechanical, chemical and biological treatment steps, nutrient removal, sewage sludge treatment and disposal

Objective qualification

Students will gain essential knowledge and skills for understanding and solving problems in the field of municipal and industrial waste and wastewater management, water supply and closed loop recycling. They will be able to use their acquired engineering skills to solve environmental problems for municipal and indu-strial employers in the fields of water supply, wastewater management, waste management und recycling. They will be able to critically discuss various process options and find adequate solutions taking into consi-deration social, scientific and ethical concerns.

Literature

Comprehensive lecture notes are available for download

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture/Exercise	german
Water Supply and Wastewater Management	2,0	Lecture/Exercise	german

Title	Basics of Environmental and Resource Protection		
Number	4306640	**Module version**	
Shorttext		**Language**	german
Frequency of offer	every term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Siedlungswasserwirtschaft
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Thomas Dockhorn
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.) or oral exam (approx. 60 Min.)		
Course achievement			

Contents

[Basic Natural Sciences for Environmental and Resource Protection (V)]
The class covers advanced questions of biological, chemical and physical processes as well as engineering fundamentals for technical resource and environment protection. Material flow cycles, resource economy and alternative treatment concepts are also part of the course.

[Eco-Balancing (VÜ)]
The class teaches methods and procedures for creating eco-balances, offers tutored case studies for creating eco-balances and discusses the special aspects of eco-balancing in the field of waste management.

Objective qualification

Students will gain essential knowledge and skills for understanding scientific and technical basics of environmental and resource protection. They will have advanced knowledge of biological, chemical and physical processes as well as engineering fundamentals for resource and environment protection (material flow cycles, resource economy, alternative treatment concepts). They will be able to create mass balances as well as eco-balances and thus will be able to critically discuss environmental impacts and resource efficiencies of various measures and products. They will be able to evaluate measures in regard to environmental impact taking into consideration social, scientific and ethical questions. They will be able to use eco-balances to understand and scientifically assess environmentally relevant problems and thus be able to support the implementation of environmental targets.

Literature

Used power point presentations are available as download

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Scientific and technical fundamentals of environmental and resource protection	2,0	Lecture	german
	2,0	Lecture/Exercise	german

Subject-specific Area Traffic and Infrastructure

Title	Basics of track-guided Traffic		
Number	2497350	**Module version**	
Shorttext	ET-SMUV-35	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Thomas Siefer
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Skipte, Materialien zur Übung			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**

Title	Traffic and Urban Planning		
Number	4302330	**Module version**	
Shorttext	BAU-STD-33	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Verkehr und Stadtbauwesen
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Bernhard Friedrich
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written Exam (120min) (in the Master's programme in Social Sciences as a course achievement)		
Course achievement			
Contents			
Objective qualification			
Literature			
Wird in der Lehrveranstaltung bekannt gegeben			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german

Title	Fundamentals in Road Pavement Engineering		
Number	4306060	**Module version**	
Shorttext	BAU-STD3-0	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Straßenwesen
Hours per Week / ECTS	6 / 6,0	**Module owner**	
Workload (h)	180		
Class attendance (h)	84	**Self studying (h)**	96
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.) or oral exam (approx. 30 Min.)		
Course achievement			

Contents

[Straßenwesen (VÜ)]
The road engineering course first introduces the students to the legal, technical and ecological framework conditions of traffic route construction. Based on this, the basics for planning, drafting and constructive implementation of road pavements in asphalt, concrete and paving construction methods are taught. In particular, the topics of route planning, formulation of road building materials, dimensioning of the road structure as well as execution and quality assurance when installing road building materials are dealt with.

[Management der Straßeninfrastruktur (VÜ)]
The course deals with the structural and operational maintenance of road infrastructure within the framework of systematic maintenance planning (Pavement Management System).

Objective qualification

Through the course, the students get to know the basic conditions for finding traffic corridors and find their way around the technical regulations and standards for road engineering. You will be able to evaluate variant studies for road construction projects, to design a road pavement as a preliminary site / grading plan and to independently determine the road cross-section and structure. In addition, you will gain an overview of the Building materials, construction methods and installation principles available for road construction.

Literature

Script

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german
	2,0	Lecture/Exercise	german

Title	Basics of track-guided Traffic		
Number	4310920	**Module version**	
Shorttext	ET-SMUV-35	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Planung des öffentlichen Verkehrs
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Thomas Siefer
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement			

Contents

[Fundamentals of track-bound traffic and public transport (V)]

- Principles of operational, tactical and strategic planning in public transport

- system-technical basics of rail traffic

- organisational and legal fundamentals of railways according to EBO and public transport according to BOStrab

- Technology and building materials for traffic route construction- Drainage and dimensioning basics for traffic route construction

- Legal and financial basics of track-guided transport

- Operational and technological basics of track plan design

- Basics of passenger and freight transport strategies

- Basics of environmental aspects of rail transport

- Basics of train haulage (locomotives, multiple units, braking technology)

- Basics of safety systems (interlocking technology and train control systems)

Objective qualification
The students acquire a basic understanding of planning processes in public transport systems, including strategic, tactical and operational planning practice. Then, the students analyse the system interrelationships in track-guided transport systems both of the railways according to the Railway Construction and Operation Regulations (EBO) and according to the Tram Construction and Operation Regulations (BOStrab). This includes the technological, construction material, drainage and dimensioning principles of traffic route construction in the inner-city area according to BOStrab as well as for railways according to EBO. Furthermore, the legal and financial principles of service planning of track-guided traffic as well as the operational and technological basics of the cycle-rail system are presented. The students also learn the basics of track plan design, safety systems in the road and railway sector, driving dynamics as well as environmental aspects of rail transport.
Literature
Vorlesungsskript, Präsentation

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german

Subject-specific Area Environmentally-compliant and Resource-saving construction

Title	Building Physics		
Number	4198180	**Module version**	
Shorttext	ARC-STD2-1	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Bauklimatik und Energie der Architektur
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Elisabeth Endres
Workload (h)			
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

Basics of climate-responsive and energy-efficient planning and building.
Comfort for occupants in rooms / buildings and hygiene.
Approximate energy balance of a building, annual energy demand, total heat transmission coefficient (U-value).
Calculation, planning and implementation of necessary thermal insulation measures on the building.
Reduction and prevention of thermal bridges, calculation of condensation for building components.
Prevention and reduction of overheating by structural measures.
Prevention of stress caused by moisture that could endanger building components.
Preventive structural fire protection, fire protection laws and regulations.
Basics of building and room acoustics, room acoustic planning.

Objective qualification

The students know the essential aspects of climate-responsive construction and are familiar with the essential regulations of building physics. They are able to determine the physical qualities of buildings and constructions such as energy balance, total energy demand or condensation risk of building components. They know about the requirements of comfort and living hygiene as well as the necessary heat and moisture protection measures in buildings. They know the requirements and possibilities of daylight or artificial light use, building acoustics and structural fire protection. Students are familiar with the common display and vocabulary to communicate with other engineering disciplines.

Literature

-Hausladen, G. et al. (2009): Ausbau Atlas. Integrale Planung, Innenausbau, Haustechnik. Basel, Berlin, München:
Birkhäuser.
-Hausladen, G. (2005): ClimaDesign. Lösungen für Gebäude, die mit weniger Technik mehr können. München: Callwey.

-Neufert, E. (2018): Bauentwurfslehre. Grundlagen Normen Vorschriften. Hg. v. Johannes Kister.
-Bohne, D. (2019): Technischer Ausbau von Gebäuden. Und nachhaltige Gebäudetechnik. Wiesbaden: Springer Vieweg.
-Pistohl, W. et al. (2016): Handbuch der Gebäudetechnik. Band 1&2. Köln: Bundesanzeiger Verlag.
-Zürcher, C. et al. (2018): Bauphysik. Bau und Energie. Zürich: vdf Hochschulverlag AG an der ETH Zürich (Bau und Energie). https://enbau-online.ch/bauphysik/
-Hayner, M. et al. (2011): Faustformel Gebäudetechnik. Für Architekten. München: Dt. Verl.-Anst.
-Albers, K.-J. (Hg.) (2018): Recknagel - Taschenbuch für Heizung und Klimatechnik. Augsburg, Essen: ITM InnoTech
Medien GmbH; Vulkan-Verlag GmbH.

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Related courses

Rules for the choice of courses

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	4,0	Lecture/Exercise	german

Literature

- C. Zürcher, T. Frank: Bauphysik, vdf, Hochschulverlag AG an der ETH Zürich und B. G. Teubner Stuttgart, 2004.

- A. Pech, C. Pöhn: Bauphysik, Springer-Verlag, Wien, 2004. (Gutes, übersichtliches Buch. Bezieht sich allerdings auf österreichische Normung # in großen Teilen identisch mit der deutschen Normung)

- P. Schulz: Schallschutz, Wärmeschutz, Feuchteschutz, Brandschutz - Handbuch für den Innenausbau, Deutsche Verlags-Anstalt, Stuttgart München, 2002.

- R. Hohmann, M.J. Setzer: Bauphysikalische Formeln und Tabellen. Wärmeschutz - Feuchteschutz # Schallschutz, Werner Verlag, Düsseldorf, 2004.

- G.C.O.Lohmeyer, H. Bergmann, M. Post: Praktische Bauphysik. Eine Einführung mit Berechnungsbeispielen, Teubner Verlag, Wiesbaden, 2005.
(zur Vertiefung geeignet)

- W. Fasold / E. Veres: Schallschutz und Raumakustik in der Praxis, HUSS-MEDIEN GmbH, Berlin.
- Musterbauordnung
- Landesbauordnung
- Durchführungsverordnung

- Vorlesungsskript
- Übungsskript

Title	Technical Equipment of Buildings		
Number	4310480	**Module version**	
Shorttext	BAU-STD4-4	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration		**Institution**	Institut für Bauklimatik und Energie der Architektur
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Elisabeth Endres
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written Exam (120 min)		
Course achievement	Portfolio		

Contents

Holistic planning of building technology at room level and building level.
Conventional and regenerative systems for energy generation and transfer (heating, ventilation, cooling).
Basics of electrical planning and building automation.
Daylight and artificial light considerations in the room.

Objective qualification

Students are able to plan, design and dimension building services systems. They are familiar with the subject-specific presentation method and the technical vocabulary in order to be able to communicate with other engineering disciplines.

Literature

Hausladen, G. et al. (2009): Ausbau Atlas. Integrale Planung, Innenausbau, Haustechnik. Basel, Berlin, München: Birkhäuser.
Hausladen, G. (2005): ClimaDesign. Lösungen für Gebäude, die mit weniger Technik mehr können. München: Callwey.
Neufert, E. (2018): Bauentwurfslehre. Grundlagen Normen Vorschriften. Hg. v. Johannes Kister.
Bohne, D. (2019): Technischer Ausbau von Gebäuden. Und nachhaltige Gebäudetechnik. Wiesbaden: Springer Vieweg.
Pistohl, W. et al. (2016): Handbuch der Gebäudetechnik. Band 1&2. Köln: Bundesanzeiger Verlag.
Zürcher, C. et al. (2018): Bauphysik. Bau und Energie. Zürich: vdf Hochschulverlag AG an der ETH Zürich (Bau und Energie). https://enbau-online.ch/bauphysik/
Hayner, M. et al. (2011): Faustformel Gebäudetechnik. Für Architekten. München: Dt. Verl.-Anst.
Albers, K.-J. (Hg.) (2018): Recknagel - Taschenbuch für Heizung und Klimatechnik. Augsburg, Essen: ITM InnoTech Medien GmbH; Vulkan-Verlag GmbH.

Remark

The lectures and calculation examples of the exercises are deepened as part of the course work in order to develop a holistic understanding of the application of building technology in design. The work is carried out

in interdisciplinary groups of students from architecture and environmental or civil engineering. The results are presented in a presentation. In addition, a booklet must be submitted.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german

Subject-specific Geotechnical Engineering and Geomonitoring

Title	Geomonitoring		
Number	4302460	**Module version**	
Shorttext	BAU-STD-46	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Geodäsie und Photogrammetrie
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Markus Gerke
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Writte exam (60 Min.) or oral exam (30 Min.)		
Course achievement			

Contents

-Introduction to precision measurement techniques in geodesy.
-Sensor systems for continuous observations
-Introduction to variance propagation
-Modeling approaches
-Practical exercises on individual topics

Objective qualification

Basic knowledge of engineering geodesy and instrumental competence will be acquired to handle monitoring tasks in the field of engineering and geosciences with the goal of recording earth surface movements. The student will acquire the ability to define and carry out small
and to carry them out by himself.

Literature

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german

Title	Geotechnical Engineering		
Number	4315010	**Module version**	
Shorttext	BAU-STD3-7	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	2	**Institution**	Institut für Geomechanik und Geotechnik
Hours per Week / ECTS	6 / 6,0	**Module owner**	Prof. Dr. Joachim Stahlmann
Workload (h)	180		
Class attendance (h)	84	**Self studying (h)**	96
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

Soil mechanics:
Introduction to the classification of soils, soil investigation, stress calculations, settlement calculations, consolidation, mechanical effect of water in soil, earth pressure, stability analysis of foundations and embankments.

Foundation engineering:
Deep foundations, bearing capacity of piles and pile grids, design and calculation of piles, excavations, support structures for excavations, anchors, dewatering, hydraulic base failure, soil improvement and injections.

Objective qualification

Introduction to geotechnical engineering, understanding of mechanical principles in soil mechanics, classification of soils, stress-deformation behavior, soil investigation, mechanical effect of water in soil, seepage flow, stress calculations, settlement calculations, earth pressure, stability analysis of soil mechanics, stability analysis of foundations and embankments.
Shallow and deep foundations, stability verifications, construction and bearing capacity of piles, excavation enclosures, support systems for excavations, anchors, dams, cuttings and slopes, groundwater and construction pit dewatering, subsoil improvement and injections.

Literature

Vorlesungsunterlagen

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german
	2,0	Lecture/Exercise	german

Subject-specific Area Construction

Title	Structural Analysis 1		
Number	4398360	**Module version**	4398360-E-FK3-V1
Shorttext	Baustatik	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Statik und Dynamik
Hours per Week / ECTS	7 / 6,0	**Module owner**	Prof. Dr. Ursula Kowalsky
Workload (h)	180		
Class attendance (h)	98	**Self studying (h)**	82
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement	Term paper		

Contents

[Baustatik I (V+Ü+T)]
Basics of design and modelling of beam structures and frameworks, basics of computational methods; idealization of constructions taking into account supports, hinges, materials as well as external actions, e.g. loads, displacements, cutting principle, governing equations for bars, beams, torsion bars, computation of statically-determined systems, kinematics of frameworks. Equations and principles of work, computation of displacement variables by means of principle of virtual forces. Computation of deflections, influence functions for displacement variables by means of Betti and Maxwell theorem.

Objective qualification

Students are able to determine and to evaluate distributions of state variables and influence functions for internal force and displacement variables for complex statically-determined constructions.

Literature

Es steht ein ausführliches Lehrbuch mit umfangreichen weiterführenden Literaturhinweisen zur Verfügung.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	5,0	Lecture/Exercise	german
	2,0	Tutorial	german

Title	Steel Constructions 1		
Number	4306740	**Module version**	
Shorttext	BAU-STD3-7	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Stahlbau
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Klaus Thiele
Workload (h)	180		
Class attendance (h)	70	**Self studying (h)**	110
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.) or oral exam+ (20 Min.)		
Course achievement	Homework		

Contents

Overview of steel construction, history of steel construction, steel products, fundamental material properties, profile section parameters, static proof using elastic-elastic and elastic-plastic analysis, static proof of bolts and welds, stability proof using equivalent member method, structural stability, design and proof of fundamental details, e.g. butt strap joint, column foot.

Objective qualification

Basic knowledge in steel construction
Basic knowledge in modeling
Basic knowledge in code regulations
Ability to design steel constructions of basic level complexity

Literature

A detailed script is available

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Related courses

Rules for the choice of courses

Compulsory attendance

Name of the course	**SWS**	**Eventtype**	**Language**
	5,0	Lecture/Exercise	german

Title	Solid Constructions 1		
Number	4306760	**Module version**	
Shorttext	BAU-STD3-7	**Language**	english
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Fachgebiet Massivbau
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Vincent Oettel
Workload (h)	180		
Class attendance (h)	70	**Self studying (h)**	110
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement	Term paper		

Contents

Areas of application of reinforced concrete construction and typical components; construction and building materials; reinforcement rules and basic design approaches; design methods for bending with and without normal force, shear force and torsion; limitations of crack width; practical design of beams, columns and uniaxial stressed plates

Objective qualification

The students will have an overview of typical applications of reinforced concrete and the structural design of simple components, such as beams, uniaxial span plates, columns etc. On that sense, basic knowledge on the structural design under normal, bending, shear and torsion stresses will be the main goal of the course.

Literature

A detailed script with all contents from the lectures is available.

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Related courses

Rules for the choice of courses

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	3,0	Lecture	german
	2,0	Exercise	german

Title	Timber Design		
Number	4316090	**Module version**	
Shorttext	BAU-IBH-09	**Language**	english
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Baukonstruktion und Holzbau
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Mike Sieder
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Skript mit den für die Vorlesungen und Übungen erforderlichen Angaben und umfangreichen Literaturhinweisen			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	4,0	Lecture/Exercise	german

Interdisciplinary Subjects

Title	Basics of Law		
Number	2216250	**Module version**	V3
Shorttext	WW-RW-25	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	2	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Anne Paschke
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
• Haug, Öffentliches Recht im Überblick, 3. Auflage 2021, • Leipold, BGB I Einführung und Allgemeiner Teil, 10. Auflage, 2019, Mohr Siebeck Verlag, • Brox/Walker, Allgemeines Schuldrecht, 46. Auflage, 2022, Verlag C.H. Beck			

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Related courses
Rules for the choice of courses
Compulsory attendance

Name of the course	**SWS**	**Eventtype**	**Language**
Basics of German Law 1	2,0	Lecture	german
Literature			
Hinweise werden in der Veranstaltung gegeben			

Basics of German Law 2	2,0	Lecture	
Literature			
Hinweise werden in der Veranstaltung gegeben			

	2,0	Exercise	german

Title	Key Qualifications		
Number	4306540	**Module version**	
Shorttext	BAU-STD3-5	**Language**	german
Frequency of offer		**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration	1	**Institution**	
Hours per Week / ECTS	0 / 16,0	**Module owner**	
Workload (h)			
Class attendance (h)	1	**Self studying (h)**	1
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Exercise	german
	3,0	Lecture/Exercise	english
	1,0	Seminar	german
Business Administration for Engineers	2,0	Online-lecture	german

	2,0	Seminar	german
Literature			
Aufgabensammlung			

	3,0	Lecture	german
Literature			
Thermodynamik kompakt [Weigand,B., Köhler, J.,von Wolfersdorf, J.; Springer-Lehrbuch, 2016]			

	1,0	Exercise	german
Literature			
Thermodynamik kompakt- Formeln und Aufgaben [Weigand,B., Köhler, J.,von Wolfersdorf, J.; Springer-Lehrbuch, 2016], Folienskript, Aufgabensammlung			

	2,0	Exercise	german
	2,0	Lecture/Exercise	german
	4,0	Lecture/Exercise	german
	4,0	Lecture/Exercise	german
Project Management for Environment and Traffic	2,0	Lecture/Exercise	german
	0,5	Lecture	german
	0,5	Exercise	german
	1,0	Internship	german
		Project	german
	2,0	Lecture/Exercise	german

Field of Graduate Study

Title	Bachelor's Thesis		
Number	4399560	**Module version**	
Shorttext	BAU-STD-14	**Language**	german
Frequency of offer		**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration	1	**Institution**	
Hours per Week / ECTS	0 / 12,0	**Module owner**	
Workload (h)	360		
Class attendance (h)	1	**Self studying (h)**	359
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**