Description of the degree program

Civil Engineering (Bachelor)
PO 7

Date: 02.02.2026

Table of contents

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	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	Technical Mechanics 3		
Number	4310500	**Module version**	
Shorttext	BAU-STD4-5	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Angewandte Mechanik
Hours per Week / ECTS	4 / 4,0	**Module owner**	Prof. Dr. Ralf Jänicke
Workload (h)	120		
Class attendance (h)	56	**Self studying (h)**	64
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

This course extends the “engineering mechanics 1” course to the dynamics of rigid bodies: kinematics, Newton’s law, conservation of momentum and energy, vibrational systems.

Objective qualification

Completion of this course enables students to determine the motion of rigid bodies caused by action of external forces. This entails free and guided motion of individual bodies, also under influence of friction, interaction between bodies during collision and vibrations.

Literature

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

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Related courses

Rules for the choice of courses

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	2,0	Tutorial	german
	4,0	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

Title	Hydromechanics		
Number	4320010	**Module version**	
Shorttext	Hydromecha	**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

Basics of Engineering

Title	Building Construction 1		
Number	4306350	**Module version**	
Shorttext		**Language**	german
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

Title	Materials Science and Chemistry for Civil Engineering		
Number	4306430	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Fachgebiet Baustoffe
Hours per Week / ECTS	6 / 6,0	**Module owner**	Dr. Thorsten Leusmann
Workload (h)	180		
Class attendance (h)	84	**Self studying (h)**	96
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement			

Contents

In the course Building Materials I, on the basis of scientific fundamentals, knowledge is imparted on the internal structure, production, processing, physical and chemical behaviour of metallic and polymeric building materials as well as on their application in construction engineering in accordance with the regulations. The following topics are covered: mechanical behaviour including load-dependent and load-independent deformation properties, stress-strain diagrams and mechanical properties, hygric behaviour and thermal behaviour. Furthermore, materials of the building industry are presented on the basis of practical examples in addition to current tasks from research. In particular, these include the building materials iron, steel, non-ferrous metals, wood and polymers. Besides the important material properties, aspects of sustainability and durability of the building materials are also dealt with.
Within the framework of seminar exercises, the acquired knowledge is deepened and practically demonstrated in small groups.

[Chemistry for Civil Engineers (V)]
In the lecture Chemistry for Civil Engineers the basic knowledge of metallic, mineral and organic building materials is imparted. Furthermore, methods for laboratory testing such as: sample collection, chemical analyses, environmental and occupational safety, calorimetry, microstructure examinations and granulometry are covered. The chemical composition of construction-relevant materials such as adhesives, resins, additives, construction chemical auxiliaries, special binders, bentonites, wood preservatives, hydrophobing agents or crack fillers are likewise addressed.

Objective qualification

After attending the module, the students will be able to describe the properties, manufacturing processes and processing techniques of the most important metallic and organic building materials and to distinguish the building materials on the basis of their characteristic properties. Based on scientific fundamentals, the students are able to describe the essential structure-related characteristics of the building materials and interrelate properties with the elementary structure of the materials.
In addition, the participants will be able to select a suitable building material based on a given requirement profile (serviceability, failure and durability behaviour), while considering the normative boundary conditions. The targeted case studies are intended to strengthen the students' ability to abstract and transfer their acquired knowledge to a novel area of concern. In combination with the fundamentals learned, key questions associated with durability and sustainability, which arise in the students' later professional lives, can be addressed and evaluated.

The students furthermore acquire the competence to depict the tests relevant for the building material properties and to select them depending on the material property to be examined as well as to evaluate test results and to assess them on the basis of the material requirements. In the field of building chemistry, students acquaint themselves with the basic knowledge of chemistry for civil engineers, with the aim of understanding the chemical investigation methods employed in the building industry. Furthermore, they are able to describe the components and principles of operation of typical chemical products utilised in construction.
Literature
Skript mit allen in der Vorlesung gezeigten Folien sowie 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
	2,0	Lecture	german

Title	Materials Science and Physics for Civil Engineering		
Number	4306450	**Module version**	
Shorttext	Baustoffku	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Fachgebiet Baustoffe
Hours per Week / ECTS	6 / 6,0	**Module owner**	Dr. Thorsten Leusmann
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

[Building Materials II (VÜ)]
In the course Building Materials II, on the basis of scientific fundamentals, knowledge is imparted on the internal structure, production, processing, physical and chemical behaviour of metallic and polymeric building materials as well as on their application in construction engineering in accordance with the regulations. The following topics are covered: mechanical behaviour including load-dependent and load-independent deformation properties, stress-strain diagrams and mechanical properties, hygric behaviour and thermal behaviour. Furthermore, materials of the building industry are presented on the basis of practical examples in addition to current tasks from research. In particular, these include gypsum, lime, cement, concrete, glass, masonry and screed mortar. Besides the important material properties, aspects of sustainability and durability of the building materials are also dealt with.
Within the framework of seminar exercises, the acquired knowledge is deepened and practically demonstrated in small groups.

[Building physics (VÜ)]
In the course Building Physics, the topics of heat and moisture transport in solid, liquid and gaseous media as well as winter and summer thermal insulation, energy balancing, condensation protection and the basics of structural sound insulation are covered.

Objective qualification

After attending the module, the students will be able to describe the properties, manufacturing processes and processing techniques of the most important mineral building materials and to distinguish the building materials on the basis of their characteristic properties. Based on scientific fundamentals, the students are able to describe the essential structure-related characteristics of the building materials and interrelate properties with the elementary structure of the materials.
In addition, the participants will be able to select a suitable building material based on a given requirement profile (serviceability, failure and durability behaviour), while considering the normative boundary conditions. The targeted case studies are intended to strengthen the students' ability to abstract and transfer their acquired knowledge to a novel area of concern. In combination with the fundamentals learned, key questions associated with durability and sustainability, which arise in the students' later professional lives, can be addressed and evaluated.
Besides, seminar exercises are set to provide students with practical experience and competence to design concrete mix formulations. The students furthermore acquire the competence to depict the tests relevant for

the building material properties and to select them depending on the material property to be examined as well as to evaluate test results and to assess them on the basis of the material requirements. In the field of building physics, students familiarise themselves with the basics of heat, moisture and sound insulation with the aim of developing an understanding of building physics processes and their interrelationships. By means of this knowledge, they can design construction details that are compliant with building physics and carry out building physics verifications.
Literature
Skript mit allen in der Vorlesung gezeigten Folien sowie 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**
	2,0	Lecture/Exercise	german
	4,0	Lecture/Exercise	german

Title	Geodesy and Geographical Information		
Number	4306660	**Module version**	
Shorttext	Geodäsie u	**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	Geotechnical Engineering		
Number	4315010	**Module version**	
Shorttext	Geotechnik	**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. Marius Milatz
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

Title	Building Construction 2		
Number	4316080	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the summer 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

Title	Construction Industry and Operation		
Number	4321010	**Module version**	
Shorttext		**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Bauwirtschaft und Baubetrieb
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Patrick Schwerdtner
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

Lean Construction; production planning; introduction to construction methods and processes; general site facilities; performance estimation of construction machinery; introduction to construction machinery; introduction to occupational health and safety measures; machinery and methods of soil engineering; lifting devices; formwork; Logistics of concrete and masonry work;
characteristics of construction; introduction to sustainable planning and construction; organizational and operational structure; tendering and contracting; wages and salary;
Work time values; methods of cost estimation; building contract; introduction to quality management; application of Building Information Modeling (BIM)

Objective qualification

After completing the module, students will be able to apply basic knowledge of production planning, scheduling and construction process engineering to the execution of construction works. They will be able to determine the general facilities as well as machinery and equipment required for a construction project as well as determine their performance. Furthermore, the students acquire the ability to apply the principles of cost and performance accounting to simple projects. In this context, the students are able to take into account selected aspects of construction contract law and quality management for the project preparation and implementation.

Literature

Lehrmaterial:
Skript zur Vorlesung "Grundlagen der Bauverfahrenstechnik"

Lehrmaterial:
Übungsskript zur Vorlesung "Grundlagen der Bauverfahrenstechnik"

Lehrmaterial:
Skript zur Vorlesung "Grundlagen der Bauwirtschaft"

Lehrmaterial: Übungsskript zur Vorlesung "Grundlagen der Bauwirtschaft"

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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	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

Engineering Specialisation - Construction Engineering

Title	Limit Load Analysis		
Number	4306440	**Module version**	
Shorttext	inaktiv	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Statik und Dynamik
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Roland Wüchner
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement	Term paper		
Contents			
Introduction to limit load analysis; Load-bearing behaviour of different cross sections: moment-curvature diagrams, dissipation, theorems of limit load, plastic limit state, kinematic method by means of principle of virtual displacements, computation of limit loads for frameworks, M-N-Q interaction; computation of deformation, plastic hinge theory of 2nd order, yield hypothesis; dimensioning of steel and reinforced concrete structures respectively.			
Objective qualification			
Students are able to compute limit loads of frameworks considering either theory of 1st or 2nd order, taking into account M-N interaction. They have gained knowledge in dimensioning constructions for given external actions.			
Literature			
A detailed script ist available			

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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	Subsurface Constructia		
Number	4306490	**Module version**	
Shorttext	Untertägig	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Geomechanik und Geotechnik
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Marius Milatz
Workload (h)	180		
Class attendance (h)	70	**Self studying (h)**	110
Compulsory requirements			
Expected performance/ Type of examination	Written exam (60 Min.)		
Course achievement			

Contents
Introduction to rock mechanics, load-bearing behavior of unconsolidated soil and rock, planning and design of tunnels, tunnelling methods for mechanized and conventional tunnelling, tunnel statics, sealing and drainage, clearance profiles and lining, fire protection, construction operations, surveying, introduction to numerics.
Objective qualification
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
	1,0	Seminar	german

Title	Steel Constructions 1		
Number	4306740	**Module version**	
Shorttext	BAU-STD3-74	**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	Concrete Construction 1		
Number	4306760	**Module version**	
Shorttext	BAU-STD3-76	**Language**	german
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	Steel Constructions 2		
Number	4313070	**Module version**	
Shorttext	BAU-IS-07	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Stahlbau
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Klaus Thiele
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+ (20 Min.)		
Course achievement	Term paper		

Contents

Design models, stability proof using second order effects, torsional flexural buckling; design and proof of details, e.g. butt strap joint
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

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

Literature

Es steht ein ausführliches Skript zur Verfügung.

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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	Timber Design		
Number	4316090	**Module version**	
Shorttext	BAU-IBH-09	**Language**	german
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

Title	Concrete Construction 2		
Number	4334200	**Module version**	
Shorttext	BAU-iBMB-20	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Fachgebiet Massivbau
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Vincent Oettel
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement	Term paper		

Contents

Design methods for standard reinforced concrete components; basic concepts of structural analysis; dimensioning of slabs (biaxially spanned slabs, multi-span slabs, slabs with openings); beams and T-beams; columns; walls; frames and foundations (slab and strip footings).

Objective qualification

By the end of this course, students will show advanced knowledge of standard reinforced concrete components design when considering general building construction. They will be able to design, dimension and detail the superstructure of a building, acquiring additional knowledge of the applicable standards/codes used in the construction sector.

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
	2,0	Lecture	german
	2,0	Exercise	german

Title	Structural Analysis 2		
Number	4398370	**Module version**	
Shorttext	Baustatik	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Statik und Dynamik
Hours per Week / ECTS	6 / 6,0	**Module owner**	Prof. Dr. Ursula Kowalsky
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

Classification of indeterminate systems. Computation of state variables of statically indeterminate systems by flexibility or displacement method; generalization of flexibility method by principle of virtual work; theorem of reduction; generalization of displacement method by principle of virtual work; duality of flexibility and displacement method, influence functions concerning force and displacement variables, computation of frameworks considering theory of 2nd order, nonlinear load-bearing behaviour, imperfections, truss models.

Objective qualification

Students are able to compute and to evaluate state variables of complex statically indeterminate systems concerning either theory of 1st or 2nd order as well as influence functions.

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
	4,0	Lecture/Exercise	german
	2,0	Tutorial	german

Title	Structural Analysis 2		
Number	4398370	**Module version**	4398370-E-FK3
Shorttext	Baustatik	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Statik und Dynamik
Hours per Week / ECTS	6 / 6,0	**Module owner**	Prof. Dr. Ursula Kowalsky
Workload (h)	180		
Class attendance (h)	84	**Self studying (h)**	96
Compulsory requirements			
Recommended requirements	Knowledge from the module "Structural Analysis 1" is assumed when taking this module.		
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement	Term paper		

Contents

Classification of indeterminate systems. Computation of state variables of statically indeterminate systems by flexibility or displacement method; generalization of flexibility method by principle of virtual work; theorem of reduction; generalization of displacement method by principle of virtual work; duality of flexibility and displacement method, influence functions concerning force and displacement variables, computation of frameworks considering theory of 2nd order, nonlinear load-bearing behaviour, imperfections, truss models.

Objective qualification

Students are able to compute and to evaluate state variables of complex statically indeterminate systems concerning either theory of 1st or 2nd order as well as influence functions.

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
	4,0	Lecture/Exercise	german
	2,0	Tutorial	german

Title	Limit Load Analysis		
Number	4306460	**Module version**	
Shorttext	Baustatik 3	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Statik und Dynamik
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Ursula Kowalsky
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.)		
Course achievement	Term paper		

Contents
Introduction to limit load analysis; Load-bearing behaviour of different cross sections: moment-curvature diagrams, dissipation, theorems of limit load, plastic limit state, kinematic method by means of principle of virtual displacements, computation of limit loads for frameworks, M-N-Q interaction; computation of deformation, plastic hinge theory of 2nd order, yield hypothesis; dimensioning of steel and reinforced concrete structures respectively.
Objective qualification
Students are able to compute limit loads of frameworks considering either theory of 1st or 2nd order, taking into account M-N interaction. They have gained knowledge in dimensioning constructions for given external actions.
Literature
A detailed script ist available

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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

Engineering Specialisation - Water and Environment

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

Title	Hydraulic Engineering and Water Resources Management		
Number	4320140	**Module version**	
Shorttext	Wasserbau	**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 Supply and Wastewater and Waste Management		
Number	4335010	**Module version**	
Shorttext	Ver- und E	**Language**	german
Frequency of offer	only in the summer 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

[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 treatment, 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 industrial 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 consideration 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	Environmental Protection		
Number	4337060	**Module version**	
Shorttext	Umweltschu	**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

Engineering Specialisation - Traffic and Infrastructure

Title	Traffic and Urban Planning		
Number	4302330	**Module version**	
Shorttext		**Language**	german
Frequency of offer		**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	Grundlagen	**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**	Prof. Dr. Michael Wistuba
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	Railway Operation Technology		
Number	4310910	**Module version**	
Shorttext	Eisenbahnb	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Eisenbahnwesen und Verkehrssicherung
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Jörn Pachl
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

[Betriebstechnik der Eisenbahn (Bahnverkehr) (VÜ)]
Basic terms of railway operations, Running time estimation, Block systems, Interlocking, Capacity evaluation and timetabling, Operational aspects of railway vehicles, Operational aspects of electric traction, Marshalling yards, Operational procedures for maintenance and construction, Operation of trams and light rail systems

For the homework and to prepare for the examination, calculation examples are demonstrated, e.g., for running time estimation. Furthermore, interlocking principles are demonstrated by a computer exercise.

Objective qualification

The students get a fundamental understanding on the principles for planning and controlling railway operations. They know the basics of timetable design under consideration of block and interlocking control methods and are able to evaluate the capacity for track layouts of low complexity. They have the basic knowledge needed to get used to the application of IT tools for timetabling and simulation.

Literature

Pachl, J.: Systemtechnik des Schienenverkehrs Bahnbetrieb planen, steuern und sichern. 9. Aufl., Verlag Springer
Vieweg, Wiesbaden 2018

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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	Basics of track-guided traffic and public transport		
Number	4310920	**Module version**	
Shorttext	Schienenve	**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 Alejandro Tirachini
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

Title	Railway Construction		
Number	4310930	**Module version**	
Shorttext	Schienenve	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Planung des öffentlichen Verkehrs
Hours per Week / ECTS	4 / 6,0	**Module owner**	Dr. Gunnar Bosse
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 Technology (V)]
Wheel-rail contact, elements and construction forms of the tracks, track technology, superstructure and substructure, dimensioning of the components of the railway superstructure, positional safety, maintenance of the superstructure, basic operational knowledge for construction planning
Superstructure, dimensioning of the components of the railway superstructure, construction sequence planning

[Routing, track elements and track topology (V/Ü)]
Line routing, points and crossings, track layout design, clearance and track spacing
In the course of the lecture, sample exercises are calculated, in particular on the routing of railways, which serve as preparation for the examination.

Objective qualification

The students learn about the tracks of different track-guided transport systems and their differences. In this context, the students acquire basic knowledge of the track structure as well as a fundamental understanding of the force transfer in the track grid as a result of permanent and variable loads. In addition, the students are enabled to plan simple construction and maintenance measures of the railway track and to understand the associated construction processes.

On the basis of the fundamental dynamic relationships between the track elements and the vehicles running on them, they will be able to carry out simple routing calculations and verifications in the area of the railway within the framework of line routing.
They are able to design simple track topologies for given operational requirements by selecting suitable switch forms.
to design simple track topologies.

Literature

-Matthews: Bahnbau
-Fendrich: Eisenbahninfrastruktur

-Weigend: Linienführung und Gleisplangestaltung

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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

Engineering Specialisation - Computational Engineering

Title	Modeling and Discretization in Solid Mechanics		
Number	4310520	**Module version**	
Shorttext	BAU-STD4-5	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Angewandte Mechanik
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Ralf Jänicke
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.) or oral exam (30 Min.)		
Course achievement	Term paper or PC-program		
Contents			
Modelling: kinematics, stress state, balance equations, overview of relevant material models. Discretization: basics of the finite element method (weak formulation, shape functions, assembly and solution of linear systems of equations, post processing).			
Objective qualification			
Students are familiar with basic concepts for the description of stress and strain in bodies and gain an overview of selected material models. They are able to discretize and solve boundary value problems in solid mechanics by the finite element method.			
Literature			
Gross, Hauger, Wriggers: Technische Mechanik 4, Springer Hutton: Fundamentals of Finite Element Analysis, McGraw-Hill			

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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	Numerical Methods in C++		
Number	4310530	**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	4 / 6,0	**Module owner**	Prof. Dr. Martin Geier
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Vorlesungsscript			

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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	Modeling and Discretization of Fluid Flow Problems		
Number	4310540	**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 / 6,0	**Module owner**	Prof. Dr. Martin Geier
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Vorlesungsscript			

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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

Multidisciplinary Subjects

Title	Lecture Series Sustainability and Digitalization		
Number	4398620	**Module version**	
Shorttext	BAU-STD5-62	**Language**	german
Frequency of offer	every term	**Teaching unit**	
Module duration	2	**Institution**	Institut für Baukonstruktion und Holzbau
Hours per Week / ECTS	4 / 4,0	**Module owner**	Prof. Dr. Mike Sieder
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	64
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	Lecture	german
	2,0	Lecture	german

Title	Key Qualifications		
Number	4398710	**Module version**	
Shorttext	BAU-STD4-3	**Language**	german
Frequency of offer	every term	**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration	6	**Institution**	
Hours per Week / ECTS	0 / 16,0	**Module owner**	
Workload (h)	480		
Class attendance (h)	210	**Self studying (h)**	210
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Literaturempfehlungen in der jeweiligen Lehrveranstaltung.			

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

	4,0	Lecture/Exercise	german
	2,0	Lecture	german
	0,5	Lecture	german
	0,5	Exercise	german
	1,0	Internship	german
	2,0	Lecture/Exercise	german

Field of Graduate Study

Title	Bachelor's Thesis		
Number	4399140	**Module version**	
Shorttext		**Language**	german
Frequency of offer	every term	**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)		**Self studying (h)**	360
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Nach Absprache mit dem Institut.			

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