



Description of the degree program

Transportation Engineering (Bachelor)

PO 9

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Mathematical Fundamentals and Computer Sciences
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Title	Modeling and Simulation of Transport Systems		
Number	2497340	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	
Module duration	1	Institution	Institut für rechnerge- stützte Modellierung im Bauingenieurwesen
Hours per Week / ECTS	5 / 6,0	Module owner	Prof. Dr. Martin Geier
Workload (h)	180		
Class attendance (h)	70	Self studying (h)	110
Compulsory requirements			
Recommended requirements	It is recommended to take part in the preliminary course "Programming in Python" first.		
Expected performance/ Type of examina- tion			
Course achievement			
Contents			
Objective qualification			
Literature			



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

Title	Mathematics for Engineers A		
Number	1294250	Module version	V2
Shorttext		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



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
	3,0	Lecture/Exercise	german
	1,0	Exercise, small group	german
	3,0	Lecture/Exercise	english
	1,0	Exercise	english
	1,0	Exercise, small group	english
	3,0	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	Numerical Methods in Engineering		
Number	4310510	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	
Module duration	1	Institution	Data-Driven Modeling of mechanical systems
Hours per Week / ECTS	4 / 4,0	Module owner	Prof. Dr. Henning Wessels
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			
Taylor series; Ansatz functions; Nonlinear equations; Newton's method; Regression; Optimization; Gradient descent; Ordinary differential equations; Numerical differentiation; Numerical Integration; Time integration; 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			



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	Engineering Mathematics and -Programming		
Number	4310570	Module version	
Shorttext		Language	german
Frequency of offer	only in the summer term	Teaching unit	
Module duration	1	Institution	Institut für rechnerge- stützte Modellierung im Bauingenieurwesen
Hours per Week / ECTS	7 / 8,0	Module owner	Prof. Dr. Manfred Krafc- zyk
Workload (h)	240		
Class attendance (h)	98	Self studying (h)	142
Compulsory requirements			
Expected performance/ Type of examina- tion	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 external 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


Related courses
Rules for the choice of courses
Compulsory attendance

Name of the course	SWS	Eventtype	Language
Mathematics for Engineers B (Differential Equations)	3,0	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

Common Engineering Fundamentals
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Title	Basics of electrical power engineering for transportation and environmental engineering		
Number	2423610	Module version	
Shorttext		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. Bernd Engel
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: Elektrotechnische Grundlagen Felix Hüning: The Fundamentals of Electrical Engineering, ISBN 978-3-11-034990-0, 2014, Oldenbourg Wissenschaftsverlag GmbH Viktor Hacker: Electrical Engineering, ISBN 978-3-11-052113-9, 2020, Walter de Gruyter GmbH Teil 2: Grundlagen der Energieversorgung Elektrische Energieversorgung, K. Heuck, Vieweg Verlag Elektrische Energieverteilung, R. Flosdorff, Teubner Verlag Teil 3: Grundlagen der elektromechanischen Energieumformung R. Fischer, Elektrische Maschinen, Hanser W. Hofmann, Elektrische Maschinen, Pearson E. Spring, Elektrische Maschinen, Springer			



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

Title	Introduction to Metrology		
Number	2511160	Module version	
Shorttext		Language	german
Frequency of offer	every term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Produktionsmesstechnik
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Rainer Tutsch
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	Written Exam (120 min)		
Course achievement			
Contents			
Measurement technology in mechanical engineering, basic terms and definitions, traceability, standards and their units, legal foundations of the unit system, measurement principles, measurement methods and methods procedures, measurement deviations and their causes, static and dynamic deviations, scale levels, location and dispersion parameters, continuous and discrete distribution functions, confidence intervals , statistical methods in measurement technology such as, in particular, error propagation, linear regression, analysis of variance, t-test, chi-square test, selected measurement methods from the field of engineering, such as, in particular, measurement of electrical quantities (indirect resistance measurement, bridge circuits, analog-digital conversion, ...), geometric measurement technology (probing strategies, hand-held measuring devices, optical, capacitive, inductive and magnetic integrated path-measuring systems, optical 2D and 2.5D measuring methods, 3D coordinate measuring methods, ...), strain measurement, force measurement, pressure measurement, weighing technology, time measurement, density measurement, temperature measurement			
Objective qualification			
Students are able to name basic terms and definitions of measurement technology and explain their meaning in the respective context. The students can discuss which aspects have to be considered in the run-up to a measurement, while carrying out a measurement and when evaluating and interpreting the measurement data obtained. Students are able to analyze possible causes of errors during measurement by understanding the interaction of measuring equipment, measurement object, environment and operator in advance and to plan suitable measures to avoid or minimize them. Students can name the most important statistical parameters and distribution functions and describe their properties. Students are able to use the most important methods of statistical measurement data evaluation, for example by calculating confidence intervals and carrying out statistical tests. Students can name, describe and sketch the most important measurement methods from the field of engineering and explain their mode of operation.			
Literature			
P. Profos, T. Pfeifer (Hrsg.): Grundlagen der Meßtechnik. 5., überarb. Aufl., München [u.a.]: Oldenbourg, 1997, ISBN: 3-486-24148-6			
H.-J. Gevatter, U. Grünhaupt: Handbuch der Mess- und Automatisierungstechnik in der Produktion, Springer Verlag, 2006, ISBN: 978-3-540-21207-2			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	1,0	Exercise	german
Literature			
Metrology in mechanical engineering, essential terms and definitions, traceability, SI units, labour agreements of the unity system, measuring signals and methods, measurement uncertainty and its causes, statistical methods in metrology (e.g. error propagation, linear regression, analysis of variance, t-test, chi-squared-test), handling of measurement signals, selected measuring tasks and concrete examples from industrial measurement technology.			
	2,0	Lecture	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			
- Gross, Hauger, Schell, Schröder: Technische Mechanik 1: Statik, Springer - Hartmann: Technische Mechanik, Wiley - Hibbeler: Technische Mechanik 1: Statik, Pearson			



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
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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			
- Gross, Hauger, Schröder, Wall: Technische Mechanik 2: Elastostatik, Springer - Hartmann: Technische Mechanik, Wiley - Hibbeler: Technische Mechanik 2: Festigkeitslehre, Pearson			



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

Fundamentals of Transportation Sciences
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Title	Fundamentals of Flight Guidance		
Number	2513240	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Flugführung
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Peter Hecker
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Recommended requirements	No specific requirements are recommended.		
Expected performance/ Type of examination	1 examination element: written exam (120 min)		
Course achievement			
Contents			
This module offers an overview over the requirements, principles and technical implementations that are necessary to guide an aircraft through the airspace and to coordinate air traffic (Air Traffic Management, ATM). In order to do so, first the requirements that have to be consider will be introduced, together with necessary direct and deriving aeronautical measures. Along this, an oversight over the systems for aircraft guidance (e.g.) and the structure of airspace will be provided as well.			
Objective qualification			
Students are able to apply their basic mathematical, physical and mechanical knowledge to the technical implementation of aircraft guidance systems. The students master the mathematical and scientific methods to analyse and abstract the various aeronautical measurement and substitute variables such as e.g. static pressure, dynamic pressure and temperature and to calculate the relevant display variables that can be derived from them such as e.g. barometric altitude, airspeed and rate of descent. The students understand the individual systems for guiding an aircraft. The students acquire a basic knowledge of the organisation of airspace and know the political, economic and ecological boundary conditions in the organisation of European air traffic.			
Literature			
1. Hesse, F., Hesse, W.; Flugnavigation - Grundlagennavigation, Kartenkunde, Koppelnavigation, Trägheitsnavigation; Breidenbach, 1984; ISBN 3-921715-03-2 2. Guidance and Control of Aerospace Vehicles; Cornelius T. Leondes; University of California Engineering and Sciences Extension Series; McCraw-Hill Book Company, Inc.; New York, San Francisco, Toronto, London; 1963 3. W. Eichenberger, Flugwetterkunde #- Handbuch für die Fliegerei, Motorbuch Verlag Stuttgart, 1995, 355 Seiten, ISBN 3-613-01683-4 4. Collinson, R.P.G.; Introduction to Avionics Systems; Boston, 2003; ISBN 1-4020-7278-3 5. Handbuch der Luftfahrt: H. Mensen; Springer-Verlag: Berlin; 2003			

6. European Air Traffic Management - Principles, Practice and Research; A. Cook; University of Westminster, UK; Ashgate Publishing Limited; Aldershot UK; 2007
7. Mansfeld, W, Satellitenortung und Navigation #- Grundlagen und Anwendung globaler Satellitennavigationssysteme
8. Attention and Situation Awareness # - A NATO AGARD Workshop, Christopher D. Wickens, Univ. of Illinois, Inst. Of Aviation, Aviation Research Laboratory

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Related courses			
Rules for the choice of courses			
Both courses have to be attended.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
	1,0	Exercise	german

Title	Surface Transportation		
Number	2539330	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Intermodale Transport- und Logistiksysteme
Hours per Week / ECTS	5 / 6,0	Module owner	Prof. Dr. Roman Henze
Workload (h)	180		
Class attendance (h)	70	Self studying (h)	110
Compulsory requirements			
Expected performance/ Type of examination	1 examination element: written exam (120 min)		
Course achievement			
Contents			
Rail vehicles: • Railroad basics • Introduction to railroad running technology • Running gear, drives and brakes of rail vehicles Fundamentals of vehicle technology: • Running resistance and tractive force equation • Traction stresses • Couplings and gearboxes • Drive concepts • Energy consumption • Braking • Fundamentals of vehicle lateral dynamics • Kinematics and forces when cornering • Self-steering behavior, parameter influences • Vehicle modeling • Vehicle vertical dynamics • Vibration comfort and driving safety			
Objective qualification			
Students acquire knowledge of the design, construction and structure of road and rail transportation vehicles. They will be able to recognize connections between vehicle technology and operating modes, use of means of transport and interactions with the surroundings and environment. They are able to communicate professionally with specialists in road and rail vehicle technology. Students will have an understanding of transport technology and the common aspects of vehicle technology for solving cross-modal tasks, e.g. with regard to environmentally relevant aspects. They are able to recognize analogies and to transfer and link knowledge specific to transport modes. Students master the basics of computer-aided design and can apply methodical knowledge to optimize complex products.			
Literature			

1. Grundwissen Bahnberufe Gerd Holzmann, Ulrich Marks-Fährmann, Klaus Restetzki, Karl-Heinz Sudwischer Verlag Europa-Lehrmittel ISBN 3-8085-7401-1
2. Drehgestelle # Bogies Karl Gerhard Baur EK-Verlag ISBN 3-88255-147-X
3. Fahrzeugtechnik Teil 1 und 2 Jürgen Janicki Eisenbahn-Fachverlag ISBN 3-9801093-9-0
4. Regionaltriebwagen Daniel Riechers Transpress Verlag ISBN 3-613-71089-7
5. ICE Daniel Riechers Transpress Verlag ISBN 3-613-71172-9
6. Schienenfahrzeugdynamik K.Knothe, S. Stichel Springer Verlag ISBN 3-540-43429-1
7. MITSCHKE, M.; WALLENTOWITZ, H.: Dynamik der Kraftfahrzeuge
8. LECHNER, G. ; NAUNHEIMER, H. : Fahrzeuggetriebe: Grundlagen, Auswahl, Auslegung und Konstruktion. Berlin: Springer-Verlag
9. ROBERT BOSCH GmbH: Kraftfahrtechnisches Taschenbuch, Wiesbaden: Vieweg Verlag
- 10.KÜÇÜKAY, F.: Grundlagen der Fahrzeugtechnik, Skriptum zur Vorlesung, Institut für Fahrzeugtechnik



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
	1,0	Exercise	german

Title	Multimodal Transport Systems		
Number	2539000000	Module version	
Shorttext		Language	english
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Intermodale Transport- und Logistiksysteme
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Jürgen Pannek
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	1 Examination: written exam+ (90 min) or oral exam+ (30 min)		
Course achievement	1 course achievement (facultative): Creation and documentation of a computer or software program (on application, the result of the course achievement can account for up to 20% of the grade of the written exam+/oral exam+) The application must be submitted to the examiner before the start of the exam+.		
Contents			
• Modes and systems in transport and logistics • Design and planning of systems • Methods of coordination			
Objective qualification			
The aim of the module is to provide an overview on intermodal transport and logistics systems with a particular focus on methods for planning, design and coordination of such systems. In particular, students shall be able to describe, explain, apply and analyze modes and systems in transport and logistics. Moreover, students can recall, interpret and evaluate key performance indicators for unimodal and intermodal systems. Regarding planning and design, students are able to characterize, apply and differentiate methods with respect to the area of application and assess suitability of these methods. Last, students are able to describe, categorize and evaluate methods of coordination regarding intermodality.			
Literature			
1. FEICHTINGER, G. ; HARTL, R.F.: Optimale Kontrolle .konomischer Prozesse. deGruyter, 2011 2. GUDEHUS, T.: Logistik: Grundlagen, Strategien, Anwendungen. 4th edt. Springer, 2010 3. GUDEHUS, T. ; KOTZAB, H.: Comprehensive Logistics. Springer, 2012 4. NEUMANN, K. ; MORLOCK, M.: Operations Research. 2nd edt. Hanser, 2004 5. SARDER, M.D.: Logistics Transportation Systems. Elsevier, 2020 6. SCH.NBERGER, J.: Model-Based Control of Logistics Processes in Volatile Environments. Springer, 2011 7. VOGT, J.J.: Business Logistics Management. 5th edt. Oxford University Press, 2016			

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

Title	Fundamentals of Traffic Engineering		
Number	2539440	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Intermodale Transport- und Logistiksysteme
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Karsten Lemmer
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: written report on the practical exercises		
Contents			
The transport engineering lecture provides a systematic overview of the fundamentals for understanding transport systems and their functions and structures as well as their technical realisation, primarily in the area of land transport. It is supplemented by excursions to manufacturers of means of transport and infrastructure facilities as well as operators of road, rail and air transport. Contents: Traffic engineering; terms, definitions, parameters of traffic elements; traffic systems; system interrelationships, traffic objects, means of transport, traffic routes, production and distribution concepts (shunting techniques, block trains, single wagonload traffic, freight transport centres, ...); traffic organisation (planning and scheduling, control and safety technology); telematics (communication and localisation); traffic physics (vehicle and traffic dynamics, modelling of traffic flows, flow dynamics); distribution of traffic, traffic control.			
Objective qualification			
After successfully completing this module, students will have acquired in-depth knowledge of the specific terminology and modelling concepts of the respective transport modes. They will have knowledge of the specialised terminology, regulations and codes of practice, including international standards. Students acquire knowledge of the physical, technological and operational fundamentals of the means of transport and infrastructure of all modes of transport, including their operational behaviour. Building on this, students are taught basic skills in dealing with various dynamic modelling concepts on the basis of microscopic physical models through to aggregated flow models. Students are able to simulate and investigate behaviour with the help of simulation models. Knowledge of the organisational forms of road, rail and air transport operations is imparted. Students will be able to assess their influence on transport operations.			
Literature			
1. Aberle, G.: Transportwirtschaft. Oldenbourg Verlag, 2009 2. Helbing, D.: Verkehrsdynamik. Springer, 1997 3. Pachtl, J.: Systemtechnik des Schienenverkehrs. Springer Vieweg, 2018 4. Pischinger, S., Seiffert, U. (Hrsg.): Vieweg Handbuch Kraftfahrzeugtechnik. Springer Vieweg, 2016 5. Schnabel, W., Lohse, D.: Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung. Beuth/Kirschbaum, 2011 6. Schnieder, E.: Verkehrsleittechnik. Springer, 2007			

7. Treiber, M., Kesting, A.: Verkehrsdynamik und -simulation. Springer, 2010.



Related courses			
Rules for the choice of courses			
The lecture is partly held in English.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	1,0	Exercise	german
	2,0	Lecture	german

Title	Traffic and Urban Planning		
Number	4302330	Module version	
Shorttext		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		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			



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 and public transport		
Number	4310920	Module version	
Shorttext		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	Alejandro Tirachini Hernández
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

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

4,0

Lecture/Exercise

german

Business and Social Sciences

Title	Fundamentals of Economics		
Number	2212140	Module version	V2
Shorttext		Language	german
Frequency of offer	every term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	2	Institution	Institut für Volkswirtschaftslehre
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Markus Ludwig
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination	1 written exam 120 (min) or 1 take-at-home exam		
Course achievement	only for Bachelor Social Sciences instead of the exam: 1 written exam 120 (min) or 1 take-at-home exam		
Contents			
• Supply and demand • Competition and market efficiency • Macroeconomic variables (gross domestic product, inflation, unemployment) • Business cycle and growth			
Objective qualification			
Students have a basic understanding of how markets work. They know the empirical-statistical background of macroeconomic variables such as GDP, inflation, unemployment and balance of payments and can describe and evaluate economic policy in Germany against the background of economic theories.			
Literature			
• Blanchard, Oliver, Illing, Gerhard: Makroökonomie, Pearson Studium, aktuelle Auflage • Mankiw, N. Gregory, Taylor, Mark P.: Grundzüge der Volkswirtschaftslehre, Schäffer-Poeschel, aktuelle Auflage • Pindyck, Robert S., Rubinfeld, Daniel L.: Mikroökonomie, Pearson Studium, aktuelle Auflage			



Related courses			
Rules for the choice of courses			
Exercises and tutorials are voluntary.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Microeconomics	2,0	Lecture/Exercise	german
Literature			
• Mankiw, N. Gregory, Taylor, Mark P.: Principles of Economics, Schäffer-Poeschel, latest edition • Pindyck, Robert S., Rubinfeld, Daniel L.: Microeconomics, Pearson Studium, latest edition			
Macroeconomics	2,0	Lecture/Exercise	german
Literature			
• Blanchard, Oliver, Illing, Gerhard: Macroeconomics, Pearson Studium, latest edition.			
Maths Revision Guide	1,0	Tutorial	german
Microeconomics for Repeaters	1,0	Exercise	german
Literature			
• Mankiw, N. Gregory, Taylor, Mark P.: Principles of Economics, Schäffer-Poeschel, latest edition • Pindyck, Robert S., Rubinfeld, Daniel L.: Microeconomics, Pearson Studium, latest edition			
Macroeconomics for Repeaters	1,0	Tutorial	german
Literature			
• Blanchard, Oliver, Illing, Gerhard: Macroeconomics, Pearson Studium, latest edition.			

Title	Fundamentals of Business Studies - Production & Logistics and Finance		
Number	2299530	Module version	V2
Shorttext		Language	
Frequency of offer	only in the summer term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	
Hours per Week / ECTS	4 / 6,0	Module owner	Studiendekan der Wirtschaftswissenschaften
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
• Dyckhoff, H.; Spengler, T. S. (2010): Produktionswirtschaft – Eine Einführung, Springer, Berlin. • Breuer, W. (2013): Finanzierung, 3. Auflage, Wiesbaden. • Breuer, W. (2012): Investition I, 4. Auflage, Wiesbaden. • Hirth, H. (2017): Grundzüge der Finanzierung und Investition, 4. Auflage, München. • Kruschwitz, L.; Lorenz, D. (2019): Investitionsrechnung, 15. Auflage, Berlin.			



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

Introduction to Finance	2,0	Lecture/Exercise	german
Literature			
•Breuer, W. (2013): Finance, 3rd edition, Wiesbaden. •Breuer, W. (2012): Investment I, 4th edition, Wiesbaden. •Hirth, H. (2017): Fundamentals of Finance and Investment, 4th edition, Munich. •Kruschwitz, L.; Lorenz, D. (2019): Investment Analysis, 15th edition, Berlin.			
Introduction to Production and Logistics	2,0	Lecture/Exercise	german
Literature			
• Dyckhoff/Spengler: Production Management (Springer, 2010, 3rd edition) • Hahn, R.: Sustainability Management (2022)			
Exam Preparation for Introduction to Production and Logistics	1,0	Exercise	german
Literature			
• Dyckhoff/Spengler: Production Management (Springer, 2010, 3rd edition) • Hahn, R.: Sustainability Management (2022)			

Title	Governance and Political Economy of Mobility and Transport		
Number	1815240	Module version	
Shorttext		Language	
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Vergleichende Regierungslehre und Politikfeldanalyse
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Nils C. Bandelow
Workload (h)	150 (h)		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Final module examination: (group) presentation		
Course achievement			
Contents			
The module includes concepts, backgrounds and theses of the most important theories of political economy and governance research. These fundamentals are applied to selected current issues and findings and critically discussed. Theories of political economy include classical political economy and the economic theory of politics (including current perspectives). Theories of governance research include normative and analytical approaches to institutional economics and their application in political science.			
Objective qualification			
The module introduces the basics of the political science field of political economy and teaches the conceptual, theoretical and methodological approaches of governance research with a particular focus on mobility and transport. Participants learn about the structures of at least one policy field in detail, are able to apply the concepts and evaluate the structures against the background of theoretical approaches and empirical findings. By participating in group tasks, presentations and discussions, participants expand their presentation, reflection and critical thinking skills. This requires regular participation in the interactive discussions, group work and exercises within the course. This requires regular attendance at both seminars.			
Literature			
Will be announced in the courses.			

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Related courses			
Rules for the choice of courses			
2 courses: [1] Course from the upper division Political Economy [2] Course from the upper division Governance of Mobility and Transport			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Political Economy	2,0	Core course	german
Literature			
The relevant literature will be discussed in the first seminar session. The key texts can be found in: May, Christian; Mertens, Daniel; Nölke, Andreas; Schedelik, Michael (2023): Political Economy: Comparative – International – Historical; Springer Fachmedien; Wiesbaden			
Governance in Selected Policy Fields	2,0	Core course	german
Literature			
The relevant literature will be discussed during the first seminar session. The basic texts can be found in: Schwedes, Canzler, Knie (eds.) (2016): Handbook of Transport Policy. 2nd edition. Wiesbaden: Springer VS.			

Elective Modules Fundamentals

Title	Automation Engineering		
Number	2412280	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Jürgen Pannek
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Recommended requirements	Control Theory or Fundamentals of Control Engineering		
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)		
Course achievement			
Contents			
Lecture/Tutorial: • Aim of automation engineering • Basics, tasks and methods of automation • Coupling and hierarchies of systems • Information and information management • Control, modularization and standardization in automation • Digitalization for industrial internet, industrial cloud and CPS • Basics of knowledge management, industrial big data and decision support			
Objective qualification			
After having completed the module automation engineering, students are able to reproduce and explain extensive basic and methodological knowledge of automation systems as well as their components (process computer, actuators, sensors, HMI). First of all, this contains that the students can explain the classification, the control and the coupling of technical processes exemplarily. They are also able to analyze information in technical processes and in signals, including signal detection and signal conversion, based on simple case examples. In addition, the students can describe basic computer structures in automation technology as well as the basics of the representation and processing of information in process computer systems in principle. Therefore, they can explain the mechanisms of process control for real-time capability and the task concept of operating systems exemplarily. They are also able to fundamentally categorize organizational, distribution and communication structures of automation systems based on simple case examples. In addition, students can reproduce basic knowledge concerning the means of description Petri Nets and are able to apply that means independently in order to model processes.			
Literature			
• Lunze, J.: Automatisierungstechnik. 5. Auflage. DeGruyter (2020) • Plenk, V.: Grundlagen der Automatisierungstechnik kompakt. Springer (2019)			

- Lai, C.: Intelligent Manufacturing, Springer (2022)
- LangmannN, C.; Turi, D.: Robotic process automation – Digitalisierung und Automatisierung von Prozessen, Springer (2020)
- Stjepandic, J.; Sommer, M.; Denkena, B.: DigiTwin: An approach for production process optimization in a built environment, Springer (2022)



Related courses			
Rules for the choice of courses			
exercise and project are optional			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Automation Engineering	2,0	Lecture	english
Automation Engineering	2,0	Exercise	english
	1,0	Project	german
Literature			
keine			

Title	Aircraft Design 1		
Number	2515030	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Flugzeugbau und Leichtbau
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Ingo Staack
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	written exam (150 min) or term paper (4 hours)		
Course achievement			
Contents			
• Introduction to the tasks of methodical aircraft design • Presentation of development directions in aircraft design • Explanation of the development processes in aircraft programs • Presentation of the iterative multidisciplinary design process • Weight systematics • Working with statistics • Geometry modeling to describe aircraft configurations • Introduction to aerodynamics and propulsion technology • Fuel calculation and consumption optimization • Questions about fuel accommodation in the aircraft • Mass-range diagram of a transport aircraft - Determination of runway lengths • Estimation of the operating empty and take-off mass • Determination of transport work • Direct operating costs (DOC) • Discussion of the most important design parameters on the technical design and economic efficiency of commercial aircraft			
Objective qualification			
Students gain an insight into the multidisciplinary design process of commercial aircraft. Here, the methodical process and the tasks to be solved are presented so that the students are able to independently set up and apply such processes for new tasks. A further objective is to convey an understanding of the technical and economic consequences of changes to the aircraft, which are discussed in an interdisciplinary (multidisciplinary) rather than subject-specific manner.			
Literature			
Heinze,W.: Entwerfen von Verkehrsflugzeugen 1 (Skript zur Vorlesung), IFL TU Braunschweig, Braunschweig 2006 Torenbeek,E.: Synthesis of Subsonic Airplane Design, Delft University Press, Martinus Nijhoff Publishers, Niederlande 1982 Roskam,J.: Airplane Design, Part 1-8, DARcorporation Design, Analysis and Research Corporation, Kansas, USA 1997			

Raymer,D.P.: Aircraft Design: A Conceptual Approach, AIAA Education Series, American Institute of Aeronautics and Astronautics Washington D.C., USA 1989
Wissenschaftliche Veröffentlichungen / scientific papers



Related courses			
Rules for the choice of courses			
Both courses have to be attended.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
	1,0	Exercise	german

Title	Basics of Automotive Design		
Number	2534260	Module version	
Shorttext		Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Fahrzeugtechnik
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Roman Henze
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Recommended requirements	There are no requirements for attending this module.		
Expected performance/ Type of examination	1 examination element: written exam (90 min)		
Course achievement			
Contents			
• Mobility and environment • Classification of motor vehicles • Object and development goals • Concept of automobiles and body • Drivetrains • Wheel and tire • Wheel suspension • Suspension, damping, steering • Basics of braking • Brake systems - structure and functions • Power transfer in braking systems • Driver assistance systems			
Objective qualification			
After completing the module, students are qualified to explain structural components, systems and components, the functioning of road vehicles in a constructive manner. They are able to explain and determine the basic functions and designs of the drivetrains, chassis and braking systems. They can compare and analyze the different driving concepts, for example, conventional, hybrid and electrical ones in terms of design, functions and energy consumption. With regard to the chassis and braking system, they are able to describe the existence, advantages and disadvantages of the different designs and carry out the corresponding calculation. They are able to create, implement and check specifications for the development of vehicles taking into account all market and customer-relevant information.			
Literature			
1. MATSCHINSKY, W.: Radführung der Straßenfahrzeuge, 2. Auflage, Springer Verlag, 1998 2. REIMPELL, J.: Fahrwerktechnik: Grundlagen. 3., überarbeitete Auflage, Vogel Buchverlag, 1995 3. HEIßING, B.: Fahrwerkhandbuch, Vieweg-Verlag, 2007 4. BREUER, B., BILL, K. H. (HRSG.): Bremsenhandbuch: Grundlagen, Komponenten, Systeme, Fahrdynamik. Vieweg Verlag, 2003			

5. BURCKHARDT, M.: Fahrwerktechnik: Bremsdynamik und Pkw-Bremsanlagen, Vogel Buchverlag, 1991
6. KÜÇÜKAY, F.: Fahrwerk und Bremsen, Skriptum zur Vorlesung, Institut für Fahrzeugtechnik
7. ROBERT BOSCH GMBH: Bremsanlagen für Kraftfahrzeuge, VDI-Verlag, 1994



Related courses			
Rules for the choice of courses			
Both courses have to be attended.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Basics of Automotive Design	2,0	Lecture	german
Basics of Automotive Design	1,0	Exercise	german
Literature			
• Mobility and environment • Classification of motor vehicles • Object and development goals • Concept of automobiles and body • Drivetrains • Wheel and tire • Wheel suspension • Suspension, damping, steering • Basics of braking • Brake systems - structure and functions • Power transfer in braking systems • Driver assistance systems			

Title	Railway Vehicles Engineering		
Number	2539280	Module version	
Shorttext		Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Maschinenbau
Module duration	1	Institution	Institut für Intermodale Transport- und Logistiksysteme
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Jürgen Pannek
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)		
Course achievement			
Contents			
• Rolling Stock (Vehicles) • Rolling Stock Components • Traction and power conversion • Auxiliary equipment and vehicle control systems			
Objective qualification			
After having completed the module, students can apply their knowledge of the design, construction, structure and operation of rail vehicles with the help of practical examples. With the historical development of railway vehicle technology in mind, they are able to present the current challenges for the railway domain and are thus able to categorise the relationships among vehicles, operations and transport infrastructures. They will also be able to describe and calculate those relationships on the mathematical basis for a number of operational and technical examples. Students can explain the system structure of rail vehicles on the basis of interfaces, vehicle components, drive and auxiliary units and categorise these within the operational aspects of a rail vehicle and link this knowledge professionally. Furthermore, they are able to explain the process of approval of a rail vehicle with the help of normative principles. By means of the accompanying lecture and practical exercises as well as practice-oriented excursions, students are enabled to explain the design and the simulation of rail vehicle components and to use the technical terms.			
Literature			
• Eckehard Schnieder: Verkehrsleittechnik, ISBN 3-540-48296-2 • Klaus Knothe, Sebastian Stichel: Schienenfahrzeugdynamik, ISBN 3-540-43429-1 • Zarko Filipovic: Elektrische Bahnen: Grundlagen, Triebfahrzeuge, Stromversorgung, ISBN 3-764-30124-4 • Wolfgang Fenner, Peter Naumann, und Jochen Trinckauf: Bahnsicherungstechnik: Steuern, Sichern und Überwachen von Fahrwegen und Fahrgeschwindigkeiten im Schienenverkehr, ISBN 978-3-8957-8683-9 • Jörn Pacht: Systemtechnik des Schienenverkehrs. Bahnbetrieb planen, steuern und sichern, ISBN 978-3-8348-8307-0			

- Ulrich Marks-Fährmann, Klaus Restetzki, Karl-Heinz Sudwischer, Grundwissen Bahnberufe Gerd Holzmann, ISBN 3-8085-7401-1



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

Title	Local Public Transport - Supply Planning		
Number	4310770	Module version	
Shorttext		Language	german
Frequency of offer	only in the summer term	Teaching unit	
Module duration	1	Institution	Institut für Verkehr und Stadtbauwesen
Hours per Week / ECTS	0 / 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 (90 Min.) or oral exam (approx. 30 Min.) (in the Master's programme in Social Sciences as a course achievement)		
Course achievement	Term paper		
Contents			
Public transport - service planning (VÜ) - organizational and legal basics of the public transport system - network planning in the context of settlement development - public transport systems and their performance capabilities - overview of circulation, vehicle and personnel planning - distribution of tickets, the organization in transport associations and tariffing - financing of public transport, - marketing strategies in public transport - differentiated modes of operation in public transport - acceleration of public transport in urban road networks			
Objective qualification			
Students will gain knowledge of the interrelationships, systems and laws that must be taken into account when planning public transport services. They will be able to design or further develop and implement public transport services for urban and rural public transport, with the respective boundary conditions and systems to be taken into account. Public transport services are differentiated for road (IVS – Prof. Friedrich) and rail transport (IVE – Prof. Siefer).			
Literature			
-Differenzierte Bedienung im ÖPNV - Flexible Bedienungsweisen als Baustein eines markorientierten Leistungsangebotes, -Blaue Buchreihe des VDV, Heft 15, DVV Media Group GmbH, April 2009. -Stadtbahnsysteme Light Rail Systems. Grundlagen, Technik, Betrieb und Finanzierung. Blaue Buchreihe des VDV, DVV Media Group GmbH, Juni 2014 -Richtlinien, Hinweise und Merkblätter der Forschungsgesellschaft für Straßen- und Verkehrswesen (www.fgsv-verlag.de). -Reinhardt, W. Öffentlicher Personennahverkehr. Vieweg + Teubner Verlag. Springer Fachmedien Wiesbaden GmbH, 2012.			



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

Title	Local Public Transport - Operation and Vehicles		
Number	4398050	Module version	
Shorttext		Language	english 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.) or oral exam (approx. 30 Min.) (in the Master's programme in Social Sciences as a course achievement)		
Course achievement			
Contents			
[Public Transport - Operation and Vehicles (V/Ü)] Introduction: -demand -Transport associations and transport communities Operation -Operational planning -Operations management -Operations supervision -organisation, management, personnel, (+telematics) vehicles: -Building and maintenance of vehicles -Energy supply; alternative drives -Operational safety and automation -circulation and vehicle dispatching/deployment distribution: -tariffing -Types of ticket sales -Free public transport Quality management / connection planning: -Awarding of bus and rail services -control New systems, multimodality, mobility development			
Objective qualification			
The students gain knowledge about the operational management of public transport, with a focus on the deployment planning of personnel and vehicles. In the area of vehicles, it is shown how vehicles are pro-cured and used according to demand. The students are able to evaluate the special features of different			

vehicle concepts (e.g. high-floor and low-floor) depending on the areas of application. Furthermore, the students acquire basic knowledge about construction, maintenance and drive technologies of vehicles. The basics of energy supply are taught. In the area of operation, students are to ensure continuous transport chains in urban traffic.

Literature

Reinhardt: Öffentlicher Personennahverkehr

Remark



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

Title	Microscopic Traffic Flow Simulation and its Applications		
Number	4301910	Module version	
Shorttext		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 (90 Min.) or oral exam (30 Min.)		
Course achievement			
Contents			
- Traffic surveys - Microscopic traffic flow modelling - Calibration and validation methods - Traffic-actuated control methods - Applications of microsimulation using professional software			
Objective qualification			
The students acquire basic knowledge of the theoretical principles of microscopic traffic flow models, for the collection of input, calibration and validation data as well as for the statistically correct evaluation of simulation results. They are enabled to plan and carry out traffic surveys and to check traffic and design planning with the help of microsimulation using the collected data. In the course of the lecture, the students learn how to use a simulation tool and are enabled to independently set up and carry out simulations with the software.			
Literature			



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

Title	Railway Operation Technology		
Number	4310910	Module version	
Shorttext		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	Railway Construction		
Number	4310930	Module version	
Shorttext		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	Alejandro Tirachini Hernández
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



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	Basics of Business Studies - Management and Marketing		
Number	2299540	Module version	V3
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Marketing und Innovation
Hours per Week / ECTS	4 / 6,0	Module owner	Studiendekan der Wirtschaftswissenschaften
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination	1 exam (120 min) or 1 take-at-home exam		
Course achievement			
Contents			
• Fundamentals of corporate management; • Fundamentals of procurement management; • Fundamentals of operational decision-making; • Basics of marketing; • Marketing research; • Objectives and basic strategies of marketing; • Marketing implementation and control			
Objective qualification			
Students have a basic understanding of general business administration and marketing. They will be able to differentiate between and describe the various business functions, in particular the three main functions of planning, decision-making and control. Students will also have acquired the ability to view business reality from a marketing perspective.			
Literature			
Introduction in Marketing: • Fritz, W. /von der Oelsnitz, D./Seegebarth, B.: Marketing. Elemente marktorientierter Unternehmensführung, 5. Aufl., Stuttgart 2019. • Meffert, H./Burmann, C./Kirchgeorg, M.: Marketing : Grundlagen marktorientierter Unternehmensführung, Konzepte - Instrumente - Praxisbeispiele, 12. Aufl., Wiesbaden 2014. • Kotler, P./Keller, K./Opresnik, M. O.: Marketing-Management, 15. Aufl., München 2017. • Homburg, C.: Grundlagen des Marketingmanagements: Einführung in Strategie, Instrumente, Umsetzung und Unternehmensführung, 5. Aufl., Wiesbaden 2017. • Folienskript			
Introduction in Corporate Governance: • von der Oelsnitz, D. (2009): Management. Geschichte, Aufgaben, Beruf, München. • Staehle, W.H. (1999): Management, 8. Aufl., München. • Schreyögg, G./Koch, J. (2020): Management: Grundlagen der Unternehmensführung, 8. Aufl., Wiesbaden			



Related courses			
Rules for the choice of courses			
Lectures compulsory. Exercises and tutorials are voluntary.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Introduction to Management	2,0	Lecture	german
Literature			
• von der Oelsnitz, D. (2009): Management. Geschichte, Aufgaben, Beruf, München • Staehle, W.H. (1999): Management, 8. Aufl., München • Schreyögg, G./Koch, J. (2020): Management: Grundlagen der Unternehmensführung, 8. Aufl., Wiesbaden			
Introduction to Marketing	2,0	Lecture	german
Literature			
• Fritz, W. /von der Oelsnitz, D./Seegebarth, B.: Marketing. Elemente marktorientierter Unternehmensführung, 5. Aufl., Stuttgart 2019 • Meffert, H./Burmann, C./Kirchgeorg, M.: Marketing : Grundlagen marktorientierter Unternehmensführung, Konzepte - Instrumente - Praxisbeispiele, 12. Aufl., Wiesbaden 2014 • Kotler, P./Keller, K./Opresnik, M. O.: Marketing-Management, 15. Aufl., München 2017 • Homburg, C.: Grundlagen des Marketingmanagements: Einführung in Strategie, Instrumente, Umsetzung und Unternehmensführung, 5. Aufl., Wiesbaden 2017 • Slide Transcript			
Review of the lecture "Introduction to Marketing"	2,0	Colloquium	german
Tutorials on Introduction to Management	2,0	Tutorial	german
Literature			
• Macharzina, K./Wolf, J. (2023): Unternehmensführung, 12. Aufl., Wiesbaden. • Staehle, W.H. (1999): Management, 8. Aufl., München. • Schreyögg, G./Koch, J. (2020): Management: Grundlagen der Unternehmensführung, 8th ed., Wiesbaden.			
Consultation colloquium "Lecture: Introduction to Management"	1,0	Colloquium	german

Title	GIS and Environmental Informatics		
Number	4398430	Module version	
Shorttext		Language	german
Frequency of offer	every term	Teaching unit	
Module duration	2	Institution	Institut für Geodäsie und Photogrammetrie
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Markus Gerke
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Wird in Vorlesung erörtert.			



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

Professionalisation

Title	Key Qualifications Transportation Engineering		
Number	2497380	Module version	
Shorttext		Language	german
Frequency of offer	every term	Teaching unit	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration	3	Institution	
Hours per Week / ECTS	0 / 11,0	Module owner	
Workload (h)	330		
Class attendance (h)	165	Self studying (h)	165
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
wird von den jeweiligen Lehrenden bekannt gegeben			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	0,5	Lecture	german
	0,5	Exercise	german
	1,0	Internship	german

	2,0	Lecture/Exercise	german
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Title	Subject-based Internship		
Number	2497400	Module version	
Shorttext		Language	german
Frequency of offer	every term	Teaching unit	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration	2	Institution	
Hours per Week / ECTS	1 / 6,0	Module owner	Dr. Stephan Hoffmann
Workload (h)	180		
Class attendance (h)	180	Self studying (h)	0
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

Title	Scientific Working Methods in Transport Engineering		
Number	4398550	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	
Module duration	1	Institution	Institut für Eisenbahnwesen und Verkehrssicherung
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Lars Schnieder
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination	Portfolio		
Course achievement			
Contents			
• Philosophy of science: causality, induction, empiricism, hypothetico-deductive reasoning, falsification, and paradigms • Good scientific practice: research cycle, responsibility, research data management, mentoring, publications, and the use of AI • Scientific writing: logical fallacies, unconscious bias, and strategies for reducing bias • Disciplinary culture in transport engineering • Literature skills: search, management, referencing, and academic reading • Role and structure of an exposé: practical exercise • Experimental design: practical exercise • Academic presentation skills: practical exercise			
Objective qualification			
• Students are able to identify key scholars and their theories, and to explain their influence on the philosophy of science. • They understand the challenges and rationale of good scientific practice. • They are able to situate their own research within the research cycle and to apply it. • They are able to independently develop an exposé. • They are able to derive an experimental design from their exposé. • They are able to present well-founded conclusions based on their exposé and experimental design in a structured presentation.			
Literature			
Judith Theuerkauf. Schreiben im Ingenieurstudium: Effektiv und effizient zu Bachelor-, Master- und Doktorarbeit. Rödiger Voss: Wissenschaftliches Arbeiten: ... leicht verständlich!			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	4,0	Seminar	german

Title	Project work in transportation engineering		
Number	4398640	Module version	
Shorttext		Language	german
Frequency of offer	every term	Teaching unit	
Module duration	2	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			
Course achievement			
Contents			
Objective qualification			
Literature			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Seminar	german
Project Management for Environment and Traffic	2,0	Lecture/Exercise	german

Field of graduate study

Title			
Number	2497390	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)	0	Self studying (h)	360
Compulsory requirements			
Expected performance/ Type of examina- tion			
Course achievement			
Contents			
Objective qualification			
Literature			
nach Absprache mit dem betreuenden Institut			



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

