



Description of the degree program

Industrial Engineering Specialized in Electrical Engineering (Bachelor)

PO 4

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Mathematics/ Fundamentals of Science

Title	Linear Algebra for Elektrical Engineering		
Number	1294010	Module version	
Shorttext	MAT-STD7-0	Language	german
Frequency of offer		Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	
Hours per Week / ECTS	0 / 6,0	Module owner	Studiendekan der Mathematik
Workload (h)			
Class attendance (h)	84	Self studying (h)	96
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
<ul style="list-style-type: none"> • R. Ansorge, H. J. Oberle, K. Rothe, T. Sonar, Mathematik für Ingenieure (2 Bände), Wiley-VCH 2010/2011 • K. Meyberg, P. Vachenauer, Höhere Mathematik (2 Bände) Springer 2003/2005 • L. Papula, Mathematik für Ingenieure und Naturwissenschaftler – Anwendungsbeispiele, Springer Vieweg 2015 			



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

	2,0	Exercise, small group	german
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Title	Analysis for Electrical Engineering		
Number	1294020	Module version	
Shorttext	MAT-STD7-02	Language	german
Frequency of offer		Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	
Hours per Week / ECTS	0 / 6,0	Module owner	Studiendekan der Mathematik
Workload (h)			
Class attendance (h)	84	Self studying (h)	96
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
	6,0	Lecture/Exercise	german
	2,0	Exercise	german

Title	Physics for Electrical Engineering		
Number	1511390	Module version	
Shorttext	PHY-IPKM-3	Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	Institut für Physik der Kondensierten Materie
Hours per Week / ECTS	5 / 5,0	Module owner	Prof. Dr. Dirk Menzel
Workload (h)	150		
Class attendance (h)	70	Self studying (h)	80
Compulsory requirements			
Expected performance/ Type of examination	written (exam 120 min)		
Course achievement			
Contents			
<p>Fundamentals of classical mechanics: inert and gravitational mass, force, acceleration, velocity, trajectories, momentum, elastic and inelastic collisions, rotary motion, torsional moment, angular momentum, angular velocity, moment of inertia;</p> <p>concepts of classical mechanics: Newtonian equations of motion, conservation of momentum, conservation of energy, conservation of angular momentum, harmonic oscillator;</p> <p>separation into classical mechanics, special relativity and quantum mechanics;</p> <p>fundamentals of thermodynamics, laws of thermodynamics, thermodynamic potentials, thermodynamic processes, entropy, ideal and real gases, diffusion, fundamentals of statistical thermodynamics, Maxwell Boltzmann distribution</p>			
Objective qualification			
<p>The students are familiar with fundamental physical quantities and concepts of classical mechanics and thermodynamics. They are able to apply the concepts (Newtonian equations of motion, conservation of energy, conservation of angular momentum, conservation of momentum, equation of harmonic oscillator, potentials in thermodynamics, laws of thermodynamics) to different fundamental physical problems and can formulate appropriate solutions.</p> <p>They autonomously perform simple physical experiments and are able to record the results following basic standards of science and technology. They are familiar with the principles of error calculation and are able to specify their results within reasonable error estimation. They can record theory, experimental methods, results, error analysis, and discussion in writing. They are able to present their results graphically in clear and comprehensive charts.</p>			
Literature			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	1,0	Exercise	german
	4,0	Lecture	german

Title	Mathematical Methods for Electrical Engineering		
Number	2499480	Module version	
Shorttext	ET-STDE-48	Language	german
Frequency of offer	every term	Teaching unit	
Module duration	2	Institution	Institut für Hochfrequenztechnik
Hours per Week / ECTS	8 / 8,0	Module owner	Prof. Dr. Jörg Schöbel
Workload (h)	240		
Class attendance (h)	112	Self studying (h)	128
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement	homework assignments		
Contents			
<p>On the basis of elementary application examples, the students acquire a descriptive understanding of methods and concepts of engineering mathematics and its references to electrical engineering and information technology. Methods and application examples from the essential areas of the fields taught in the mathematics modules are explained in the lecture and worked on independently by the students in the form of homework and discussed in the small exercise class.</p> <p>The lectures also prepare for parts of the exams Linear Algebra and Analysis for Electrical Engineering.</p> <p>Overview of the essential contents A (application examples in brackets)</p> <ul style="list-style-type: none"> - Equations and inequations with one or several unknowns, treatment of complications such as absolute values or case distinction etc. - Real and complex numbers (calculation of ac circuits problems) - Vector spaces, orthogonality, norm, basis (RMS, power, SNR) - linear transformations and matrices, linear sets of equations, LR and Gauss algorithms (passive linear circuits) - Gram-Schmidt, projections (idea of Fourier series) - Determinants, eigenvalues, eigenvectors, principal axis theorem - Ordinary differential equations, systems of linear 1st order differential equations (transmission line equations, wave equation, resonant LC circuit, harmonic oscillator) <p>Overview of the essential contents B (application examples in brackets)</p> <ul style="list-style-type: none"> - Nonlinear equations, Newton's method - Sequences and series - Continuous and differentiable functions of one real argument, extrema (power matching) - Integration, fundamental theorem of calculus - Taylor series, Fourier series - Differentiable functions of more than one variable, partial derivatives - Extrema, optimization subject to equality constraints - Curves and surfaces in space, vector fields, basic concepts of vector analysis (electromagnetic fields) - Integration (line/surface/volume integrals), coordinate transformations - Integral invariants and transformations: Gauss/divergence theorem, Stokes theorem, Green's identities 			
Objective qualification			

Students acquire a descriptive understanding of mathematics as a fundamental tool in electrical engineering and information technology

- (1) as means of abstract description of physical and technical concepts and relations
- (2) as a tool for modeling and analysis of physical-technical structures and systems
- (3) as a method for manipulation of signals and other entities that are represented numerically.

Hence, students understand how mathematical concepts and methods are applied and recognize which methods are suitable for modeling and solution of physical, technical or information-technological problems. To form a basis for the methodical understanding, students improve their numeracy skills. They command fundamental mathematical methods and know how to apply these on electrical and information-theoretical problems. In the field of numerical computation students have a basic understanding of exemplary numerical methods.

Literature

R. Ansorge, H. J. Oberle, K. Rothe, T. Sonar, Mathematik für Ingenieure (2 Bände), Wiley-VCH 2010/2011
 K. Meyberg, P. Vachenauer, Höhere Mathematik (2 Bände) Springer 2003/2005
 L. Papula, Mathematik für Ingenieure und Naturwissenschaftler – #Anwendungsbeispiele, Springer Vieweg 2015



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

Basics of Electrical Engineering and Information Technology

Title	Fundamentals of Electrical Engineering		
Number	2412630	Module version	
Shorttext	ET-IFR-63	Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	2	Institution	Institut für Elektromagnetische Verträglichkeit
Hours per Week / ECTS	10 / 10,0	Module owner	Prof. Dr. Michael Terörde
Workload (h)	300		
Class attendance (h)	140	Self studying (h)	160
Compulsory requirements			
Expected performance/ Type of examination	Written exam (180 min)		
Course achievement	Homework (§ 4, 14 BPO), will be specified in the first lectures.		
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	Exercise	german
	1,0	Seminar	german

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	2,0	Exercise	german
	1,0	Seminar	german
	2,0	Lecture	german

Title	Fundamentals of Electronics		
Number	2413500	Module version	
Shorttext	ET-IHT-12	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Andreas Waag
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (150 min)		
Course achievement			
Contents			
<ul style="list-style-type: none"> • Electronic properties of semiconductors • Diode • FET • Bipolar transistors • Circuit technology • Digital electronics • Optoelectrical components • Integrated circuits and semiconductor technological processes 			
Objective qualification			
<p>Students will be able to calculate and explain the principles, modes of operation and electrical properties of important semiconductor components (diodes, bipolar transistors, thyristors and field-effect transistors) and plan their use in simple analogue and digital basic circuits. This subject area also includes a description of the nature of charge transport in semiconductors and its physical principles. To this end, the students solve differential equations to describe local field strength, band edge and charge carrier concentration curves and calculate the resulting current transport. As a result, they obtain characteristic curves of important semiconductor components. The functionalities and areas of application of optoelectronic components such as light-emitting diodes, lasers, photodetectors and solar cells can be described in detail. Students will also be able to grasp the physical principles of optoelectronic components and describe their significance for applications. They can confidently describe the basic physical concepts for describing the electrical and optical properties of semiconductors on the basis of crystal and band structures and the quantities derived from them. They can also reproduce basic concepts of CMOS design and describe key technological processes. They will be able to analyse the small-signal behaviour of simple analogue amplifier circuits.</p>			
Literature			
# A. Schlachetzki: "Halbleiter-Elektronik", Teubner Studienbücher, B.G. Teubner, Stuttgart, 1990 ISBN: 3-519-03070-5			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	3,0	Lecture	german
Literature			
A. Schlachetzki: "Halbleiter-Elektronik", Teubner Studienbücher, B.G. Teubner, Stuttgart, 1990			
	1,0	Exercise	german
Literature			
Übungsskript (Aufgaben mit Lösungen) zum Herunterladen			

Title	Basics of Electrical Power Engineering		
Number	2414320	Module version	
Shorttext	ET-IMAB-32	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	6 / 6,0	Module owner	Prof. Dr. Markus Henke
Workload (h)	180		
Class attendance (h)	84	Self studying (h)	96
Compulsory requirements			
Expected performance/ Type of examination	Written exam (180 min)		
Course achievement			
Contents			
<p>Part 1:</p> <ul style="list-style-type: none"> - Fundamentals of energy supply - Fundamentals of electrical power transmission - High-voltage three-phase current transmission, three-phase current systems, three-phase current transformers, synchronous generators, overhead lines and cables - Power plant control - Faults in three-phase networks - High-voltage direct current transmission - Fundamentals of the electrical energy industry - Primary and secondary energies - Electrical energy generation, thermodynamic principles. Joule process, Clausius-Rankine process - Gas turbine power plant, steam power plant, combined cycle power plants - Basics of high voltage technology - Voltage stresses in the grid, insulation coordination - Electrical strength, calculation of electrical fields, utilisation factor according to Schwaiger - Breakdown voltage, breakdown field strength - Protective measures, personal protection in low-voltage systems <p>Part 2:</p> <ul style="list-style-type: none"> - Fundamentals of electromechanical energy conversion - Forces in magnetic circuits - Function and description (equivalent circuit diagrams) of the basic types of electrical machines - Operating behaviour of direct current machines - Rotating and travelling fields, mathematical description - Synchronous machine - Asynchronous machine <p>Part 3:</p> <ul style="list-style-type: none"> - Fundamentals of power electronics - Components of power electronics - Power semiconductors and their applications - Basic power converter circuits 			

<ul style="list-style-type: none"> - Network perturbations - Reactive power - Inverter basics
Objective qualification
<p>After completing this part of the module, students will be able to</p> <p>Part 1:</p> <ul style="list-style-type: none"> - understand and apply basic knowledge of equivalent circuits of operating equipment - apply complex calculations in three-phase networks for operating and short-circuit cases - apply the mathematical relationships to specific tasks <p>Part 2:</p> <ul style="list-style-type: none"> - understand the basic modes of operation of electromagnetic converters (electrical machines) - analyse and interpret the equations describing the basic operating behaviour of direct current, asynchronous machines and synchronous machines apply the mathematical relationships to specific tasks <p>Part 3:</p> <ul style="list-style-type: none"> - derive from the structure of power semiconductor switches commonly used today their mode of operation and electrical behaviour - understand the mode of operation of basic power converter circuits from the group of rectifiers, direct current controllers, inverters and converters and name application examples - analyse and mathematically describe the relationship between input and output variables of these basic circuits
Literature



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	4,0	Lecture	german
Literature			
Teil 1: Grundlagen der Energieversorgung Elektrische Energieversorgung, K. Heuck, Vieweg Verlag Elektrische Energieverteilung, R. Flosdorff, Teubner Verlag Teil 2: Grundlagen der elektromechanischen Energieumformung R. Fischer, Elektrische Maschinen, Hanser Binder, Elektrische Maschinen und Antriebe: Grundlagen, Betriebsverhalten, Springer Teil 3: Grundlagen der Leistungselektronik Leistungselektronik - Grundlagen und Anwendung, R. Jäger, E. Stein, VDE-Verlag Grundkurs Leistungselektronik, Joachim Spe-covius, Vieweg-Verlag			
	2,0	Exercise	german

Title	Foundations of Electromagnetic Field Theory		
Number	2419100	Module version	
Shorttext	ET-IEMV-10	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	4 / 5,0	Module owner	Prof. Dr. Achim Enders
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 min) or oral exam (30 min)		
Course achievement			
Contents			
<p>Introduction into the classical electromagnetic field theory:</p> <ul style="list-style-type: none"> • physical basic principles • transition from the Coulomb and Biot-Savart-Ampere force equations to the differential formulation • Faraday law of induction • Maxwell's displacement current • Maxwell equations • Plane waves as solutions of the homogeneous wave equation • Fresnel equations 			
Objective qualification			
<p>The students are able to present and explain the foundations of the electromagnetic field theory. They can distinguish between integral and local conceptions and they can justify the more general meaning of the local approach by partial differential equations. They understand the assumptions for simplifications of equations and can decide whether they are met for a given problem. They can calculate force fields for given source distributions. They can describe the reaction of material in the electromagnetic field and derive the extension of the microscopic to the macroscopic Maxwell equations. They can apply the Maxwell equations in material and at boundaries. They can analyze and calculate the propagation of plane waves and their interaction with material for basic geometries. They can choose and apply solution approaches for elementary problems.</p>			
Literature			
<ul style="list-style-type: none"> • Lecture notes • Günther Lehner, Elektromagnetische Feldtheorie für Ingenieure und Physiker, Springer-Verlag Berlin, 2008, ISBN 978-3-540-77681-9 # • Karl Kupfmüller, Theoretische Elektrotechnik und Elektronik, Springer-Verlag, Berlin, 2000, ISBN 3-540-67794-1 • Karoly Simonyi, Theoretische Elektrotechnik, Johann Ambrosius Barth, Leipzig, 1993, ISBN 3-335-00375-6 # • David J. Griffiths, Introduction to Electrodynamics, Prentice Hall, New Jersey, 1999, ISBN 0-13-919960-8 			



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	Fundamentals of Information Technology		
Number	2424610	Module version	V2
Shorttext	ET-NT-61	Language	
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	5 / 6,0	Module owner	Prof. Dr. Eduard Jorswieck
Workload (h)	180		
Class attendance (h)	84	Self studying (h)	96
Compulsory requirements			
Expected performance/ Type of examination	Written exam 120 min – 3 parts à 40 min		
Course achievement			
Contents			
<p>Physical principles of communication:</p> <ul style="list-style-type: none"> - The electromagnetic wave - The wireless channel - Antennas - Propagation of e/m waves - Calculation of radio links - THz communication - Radio systems - Optical communication - Silicon Photonics - Plasmonics <p>Communications Engineering:</p> <ul style="list-style-type: none"> - Basic terms and concepts of communications engineering - History of communications engineering - Models, contents and media of communications engineering - Source and source coding - Signals, systems, modulation methods - Transmission channels - Decision theory - Channel coding <p>Communication networks:</p> <ul style="list-style-type: none"> - Data Link Layer: Ethernet - Network Layer: Store and Forward - Network Layer: Delay, Loss, and Throughput - Network Layer: Routing Protocols and Algorithms - Transport layer: TCP and UDP baselines, new transport protocols - Performance evaluation: theoretical and practical methods 			

- Network Security: Fundamentals of Cryptography
Objective qualification
Students will be able to name the basic concepts of information technology and divide them into the fundamentals of communications engineering, communications networks and communications and their underlying physical principles. Students are able to distinguish the three areas from each other, to grasp their connections, dependencies and interactions, and to classify important tasks in information technology research and development. They know and understand basic models of modern communication systems and networks on the technological layers (physical, transmission, multiple access and network layers) and can construct new models for future technologies. In addition, they are able to assess which theoretical aspects of information technology need to be addressed to advance research in the field.
Literature
<ol style="list-style-type: none"> 1. J. G. Proakis, M. Salehi, Grundlagen der Kommunikationstechnik, Pearson Studium, 2. Auflage, 2004. 2. M. Bossert, Einführung in die Nachrichtentechnik, Oldenbourg Verlag, 2012. 3. A. F. Molisch, Wireless Communications: From Fundamentals to Beyond 5G (Wiley - IEEE) 4. P. P. Sahu, Fundamentals of Optical Networks and Components 5. Deep Medhi and Karthik Ramasamy. Network Routing - Algorithms, Protocols, and Architectures (2nd ed.). Morgan Kaufmann. 6. James F. Kurose and Keith Ross. Computer Networking: A Top-Down Approach (8th ed.). Pearson. 7. Dimitri Bertsekas und Bob Gallager. Data Networks, Second Edition, Prentice Hall.



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
Literature			
Foliensatz zur VL			
	1,0	Lecture	german
	1,0	Lecture	german
	2,0	Lecture	german
Literature			
- Skript - Vorlesungsbegleitendes Multimedia-Lernprogramm (CD) - Martin Werner: Nachrichtentechnik, Reihe: Studium Technik, Vieweg+Teubner Verlag, ISBN 3-8348-0456-8, 2009			

Title	Fundamentals of Control Engineering		
Number	2412600	Module version	
Shorttext	ET-IFR-60	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	4 / 5,0	Module owner	Marcus Grobe
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 min)		
Course achievement			
Contents			
Basics, block diagram, modeling of dynamic systems with concentrated elements, differential equations, linearization, frequency range, frequency response, Nyquist diagram, Bode diagram, typical individual elements of controlled systems, transfer function, control loop, stability, controller design, equivalent time constant, root locus method, cascade control, use of microcomputers, discrete-time control systems, difference equations, z-transform, digital signal processing, filters, bilinear transform, compensation controller, dead beat controller			
Objective qualification			
After completing the module, the students have basic knowledge in the field of linear control engineering. They know the properties and dynamic behavior of basic control engineering components and standard controllers. Students will be able to describe the basic features of digital signal processing and explain the operation of a digital control system. They understand the concepts for the description of linear as well as simple nonlinear dynamic systems in the time domain and in the frequency domain as well as the concept of Laplace and Z-transformation. They can model linear time-invariant systems with lumped memories and design controllers in the frequency domain. This includes the design by means of pole placement, the method of equivalent time constants, as well as working in the Bode diagram and the design of discrete-time controllers. Furthermore, the students are able to analyze the stability of closed control loops and to evaluate their quality.			
Literature			
<ul style="list-style-type: none"> - Lecture notes - J. Lunze: Regelungstechnik 1 & 2, Springer-Verlag, ISBN: 978-3540689072 & 978-3540784623 - R. Unbehauen: Regelungstechnik 1 & 2, Vieweg-Verlag, ISBN: 978-3834804976 & 978-3528833480 - O. Föllinger: Regelungstechnik, Hüthig-Verlag, ISBN: 978-3778529706 - W. Leonhard: Einführung in die Regelungstechnik, Vieweg-Verlag, ISBN: 978-3528535841 			

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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
	1,0	Exercise	german

Title	Basic Circuit Theory		
Number	2420180	Module version	
Shorttext	ET-BST-18	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	7 / 8,0	Module owner	Prof. Dr. Vadim Issakov
Workload (h)	240		
Class attendance (h)	98	Self studying (h)	142
Compulsory requirements			
Expected performance/ Type of examination	Exam+, 150 min		
Course achievement	Homework assignments (according to APO § 9), details will be specified in the first lectures. Upon request, the result of the course achievement can be accounted for the written exam+ to 15 %.		
Contents			
<ul style="list-style-type: none"> - Kirchhoff's laws - Systematic determination of linearly independent mesh and intersection equations by using graph theory - Linear time-invariant circuit models with ideal switches - Motivation and formulation of the answer of a general, linear, time-invariant circuit model - Asymptotic stability, representation of the response in steady state - Harmonic steady state and frequency response - Response from the steady state - Determination of the responses in the steady state and from the resting state using the frequency response - Convolution product and system behavior - Linear algebraic network equation systems - Tableau of the circuit equations - Intersection admittance, nodal admittance and mesh impedance methods - Source displacement - Modified Nodal Approach - Small-signal analysis of non-linear, time-invariant circuits - Operational amplifiers 			
Objective qualification			
Students acquire knowledge of circuit analysis methods based on frequency responses. Furthermore, the system behavior of circuits is examined. After completing this module, they will be able to calculate the temporal behavior of linear, time-invariant circuits in many relevant aspects.			
Literature			

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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
	2,0	Exercise, small group	german

Title	Signals and Systems		
Number	2424640	Module version	
Shorttext	ET-NT-64	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Eduard Jorswieck
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 (30 min)		
Course achievement			
Contents			
<p>Signal description in time domain Signal operation and special signals Elementary, static, and dynamic systems Linear time-continuous systems Non-linear time-continuous systems Signal description in frequency domain System description in time domain System properties: stability, invertibility, causality Fourier transform, Fourierintegral, Laplace transform, Laplaceintegral, inverse Laplace transform Relation time and frequency domain, realization Stationary and volatile process Frequency characteristics Bode diagrams System properties: Classification Stability, all-pass filter, minimum phase system Hilbert transform</p>			
Objective qualification			
<p>The students know the basic, ordering meaning of the concept of systems in engineering. They understand the general approach of system theory as well as applications to analog continues-time systems. They master the application of signal transformations (Fourier, Laplace) for effective description of the system behaviour in frequency domain. In particular, they are able to apply the system theoretic way of thinking to important sub-areas of their field of study, for example to the computation of electoral networks with non-sinusoidal excitation.</p>			
Literature			
<p>#Wunsch, G. ; Schreiber, H.: "Analoge Systeme", 4. Auflage, TUDpress Verlag der Wissenschaften GmbH, 2006. # ISBN 10: 3938863676 #Oppenheim, A. von ; Willsky, A.: "Signals & Systems", 2. Auflage, Pearson, 1996, ISBN 10: 0138147574 Ohm, J. ; Lüke, H.-D.: "Signalübertragung", 12. Auflage, Springer, 2014, ISBN 978-3-642-53901-5 Haykin, S. : "Signals and Systems", 2. Auflage, John Wiley & Sons, 2003, ISBN-10: 0471378518</p>			

Kreß, D. ; Kaufhold, B.: "Signale und Systeme verstehen und vertiefen - Denken und Arbeiten im Zeit- und Frequenzbereich", Vieweg+Teubner Verlag / Springer Fachmedien Wiesbaden GmbH, 2010, ISBN-10: 3834810193



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
Literature			
<p>? Wunsch, G. ; Schreiber, H.: "Analoge Systeme", 4. Auflage, TUDpress Verlag der Wissenschaften GmbH, 2006. ? ISBN 10: 3938863676 ? Oppenheim, A. von ; Willsky, A.: "Signals & Systems", 2. Auflage, Pearson, 1996, ISBN 10: 0138147574 ? Ohm, J. ; Lüke, H.-D.: "Signalübertragung", 12. Auflage, Springer, 2014, ISBN 978-3-642-53901-5 ? Haykin, S. : "Signals and Systems", 2. Auflage, John Wiley & Sons, 2003, ISBN-10: 0471378518 ? Kreß, D. ; Kaufhold, B. : "Signale und Systeme verstehen und vertiefen - Denken und Arbeiten im Zeit- und Frequenzbereich", Vieweg+Teubner Verlag / Springer Fachmedien Wiesbaden GmbH, 2010, ISBN-10: 3834810193</p>			
	2,0	Exercise	german
Literature			
<p>? Wunsch, G. ; Schreiber, H.: "Analoge Systeme", 4. Auflage, TUDpress Verlag der Wissenschaften GmbH, 2006. ? ISBN 10: 3938863676 ? Oppenheim, A. von ; Willsky, A.: "Signals & Systems", 2. Auflage, Pearson, 1996, ISBN 10: 0138147574 ? Ohm, J. ; Lüke, H.-D.: "Signalübertragung", 12. Auflage, Springer, 2014, ISBN 978-3-642-53901-5 ? Haykin, S. : "Signals and Systems", 2. Auflage, John Wiley & Sons, 2003, ISBN-10: 0471378518 ? Kreß, D. ; Kaufhold, B. : "Signale und Systeme verstehen und vertiefen - Denken und Arbeiten im Zeit- und Frequenzbereich", Vieweg+Teubner Verlag / Springer Fachmedien Wiesbaden GmbH, 2010, ISBN-10: 3834810193</p>			

Basics of Economic Sciences

Title	Fundamentals of Economics		
Number	2212140	Module version	V2
Shorttext	WW-VWL-14	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			
<ul style="list-style-type: none"> • 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			
<ul style="list-style-type: none"> • 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 			

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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			
<ul style="list-style-type: none"> • 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 			
Macroeconomics	2,0	Lecture/Exercise	german
Literature			
<ul style="list-style-type: none"> • 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. 			
	1,0	Tutorial	german
Microeconomics for Repeaters	1,0	Tutorial	german
Literature			
<ul style="list-style-type: none"> • 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 			
Macroeconomics for Repeaters	1,0	Tutorial	german
Literature			
<ul style="list-style-type: none"> • 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. 			

Title	Accounting		
Number	2214120	Module version	V2
Shorttext	WW-ACuU-12	Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Controlling und Unternehmensrechnung
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Heinz Ahn
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			
Contents			
<ul style="list-style-type: none"> • Overview of capital market-oriented accounting in accordance with IFRS • The technique of posting business transactions • General recognition and measurement rules • Presentation of the financial position • Presentation of the earnings position • Presentation of the financial position • Basic concepts of cost and revenue accounting • Cost and revenue type accounting • Cost centre accounting • Cost and revenue element accounting • Cost and activity accounting systems based on partial costs 			
Objective qualification			
After completing this module, students will have a basic understanding of the tasks and methods of industrial accounting. This applies to external and internal accounting.			
Literature			
<ul style="list-style-type: none"> • Zimmermann, J./Werner, J.R.: Buchführung und Bilanzierung nach IFRS, Pearson Studium, München 2008 (bzw. ggf. aktuellere Auflage) • Deimel, K./Isemann, R./Müller, S.: Kosten und Erlösrechnung - Grundlagen, • Managementaspekte und Integrationsmöglichkeiten der IFRS, Pearson Studium, München 2006 (bzw. ggf. aktuellere Auflage) 			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Accounting and Financial Reporting	2,0	Lecture	german
Tutorial - Accounting and Financial Reporting	2,0	Exercise	german
Literature			
<ul style="list-style-type: none"> • Zimmermann, J./Werner, J. R./Hitz, J.-M. (2020): Buchführung und Bilanzierung nach IFRS und HGB, 4. Aufl., Pearson • Deimel, K./Erdmann, G./Isemann, R./Müller, S. (2017): Kostenrechnung: Das Lehrbuch für Bachelor, Master und Praktiker, Pearson, Kapitel 1–6 			

Title	Introduction to Business Information Systems		
Number	2222150	Module version	V2
Shorttext	WW-WII-15	Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Wirtschaftsinformatik - Abteilung Service-Informationssysteme
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Susanne Robra-Bissantz
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	1 exam (90 min) or 1 take-at-home exam		
Course achievement			
Contents			
<ul style="list-style-type: none"> • Overview of business informatics • Hardware, software and networking • Enterprise models: data, function and process modelling • Application development and project management • Integrated application systems in industry and services • Inter-company information systems: e-commerce, electronic markets • IT and corporate strategy: e-business management, customer relationship management, supply chain management, digital products • Management of information processing (information management, process management, knowledge management) 			
Objective qualification			
<p>The "Introduction to Business Information Systems" module provides students with an overview of business information systems: as an interdisciplinary subject between business administration, computer science and technology and as an independent subject that considers the relationships between people, (business) tasks and technology.</p> <p>Participants are familiar with the operational and inter-company areas of application of business informatics and know how business management tasks are supported with integrated application systems. They know and master the essential approaches to the design and introduction of application systems and their significance in the management of the company's information system. In addition, they have an idea of new developments in business informatics, e.g. in inter-company relationships of the company with customers and partners or in electronic markets.</p>			
Literature			
<ul style="list-style-type: none"> • Mertens et al.: Grundzüge der Wirtschaftsinformatik, 9. Auflage, Berlin et al. 2005. • Lehner, F., Wildner, S., Scholz, M.: Wirtschaftsinformatik. Eine Einführung, München, Wien 2008. • Laudon, K. et al.: Wirtschaftsinformatik: Eine Einführung, München 2006 • Stahlknecht, P., Hasenkamp, U.: Einführung in die Wirtschaftsinformatik, 11. Auflage, Berlin et al. 2005 • Vorlesungsunterlagen zum Download 			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Introduction to Business Information Systems	3,0	Lecture/Exercise	german
Literature			
<ul style="list-style-type: none"> • Mertens et al.: Grundzüge der Wirtschaftsinformatik, 9. Auflage, Berlin et al. 2005 • Lehner, F., Wildner, S., Scholz, M.: Wirtschaftsinformatik. Eine Einführung, München, Wien 2008 • Laudon, K. et al.: Wirtschaftsinformatik: Eine Einführung, München 2006 • Stahlknecht, P., Hasenkamp, U.: Einführung in die Wirtschaftsinformatik, 11. Auflage, Berlin et al. 2005 • Vorlesungsunterlagen zum Download 			

Title	Fundamentals of Business Studies - Production and Logistics and Finance		
Number	2299530	Module version	V2
Shorttext	WW-STD-53	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			
<ul style="list-style-type: none"> • 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. 			

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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			
<ul style="list-style-type: none"> •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. 			
Principles of Production and Logistics	2,0	Lecture/Exercise	german
Literature			
<ul style="list-style-type: none"> • Dyckhoff/Spengler: Produktionswirtschaft (Springer, 2010, 3. Auflage) • Hahn, R.: Sustainability Management (2022) 			
Exam Preparation for Principles of Production and Logistics	1,0	Exercise	german
Literature			
<ul style="list-style-type: none"> • Dyckhoff/Spengler: Produktionswirtschaft (Springer, 2010, 3. Auflage) • Hahn, R.: Sustainability Management (2022) 			

Title	Fundamentals of Business Studies - Management and Marketing		
Number	2299540	Module version	V2
Shorttext	WW-STD-54	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			
<ul style="list-style-type: none"> • 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			
<p>Einführung in das Marketing:</p> <ul style="list-style-type: none"> • Fritz, W. /von der Oelsnitz, D./Seegebarth, B.: Marketing. Elemente marktorientierter Unternehmensführung, 5. Aufl., Stuttgart 2019. • Meffert, H./Burmans, 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 <p>Einführung in die Unternehmensführung:</p> <ul style="list-style-type: none"> • von der Oelsnitz, D. (2009): Management. Geschichte, Aufgaben, Beruf, München. • Staehle, W.H. (1999): Management, 8. Aufl., München. • Steinmann, H./Schreyögg, G. (2005): Management, 6. 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			
<ul style="list-style-type: none"> • von der Oelsnitz, D. (2009): Management. Geschichte, Aufgaben, Beruf, München • Staehle, W.H. (1999): Management, 8. Aufl., München • Steinmann, H./Schreyögg, G. (2005): Management, 6. Aufl., Wiesbaden 			
Introduction to Marketing	2,0	Lecture	german
Literature			
<ul style="list-style-type: none"> • 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 			
	2,0	Colloquium	german
	2,0	Tutorial	german
Literature			
<ul style="list-style-type: none"> • Macharzina, K./Wolf, J. (2005): Unternehmensführung, 4. Aufl., Wiesbaden. • Staehle, W.H. (1999): Management, 8. Aufl., München. • Steinmann, H./Schreyögg, G. (2005): Management, 6. Aufl., Wiesbaden. 			
	1,0	Colloquium	german

Electrical Engineering Specialisation
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Title	Measurement Electronics		
Number	2411230	Module version	
Shorttext	ET-EMG-23	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	3 / 5,0	Module owner	Prof. Dr. Meinhard Schilling
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	78
Compulsory requirements			
Expected performance/ Type of examination	Oral exam (30 min), written exam (120 min) only for a high number of participants		
Course achievement			
Contents			
Measuring amplifiers with transistors and OPVs Electronic switches Source circuits Measuring transducers Analogue filter circuits Treatment of interference signals and noise Correlation analysis Measurement converters (A/D and D/A) Measuring device buses Time measurement Oscilloscopes and trigger circuits			
Objective qualification			
After completing the 'Measurement Electronics' module, students will have an overview of circuit technology and measurement methods in measurement electronics. The practical knowledge they have acquired enables them to set up circuits for measurement applications.			
Literature			
<ul style="list-style-type: none"> - A multi-media CD ROM with script and exercises is available for the lecture - Allan R. Hambley #Electronics#, Prentice Hall, ISBN 978-0136919827 - U. Tietze, Ch. Schenk #Halbleiter-Schaltungstechnik#, Springer-Verlag, 2002, ISBN 978-3540641926 - Dieter Nührmann #Das komplette Werkbuch Elektronik#, Franzis-Verlag, ISBN 978-3772365263 - P. Horowitz #The Art of Electronics#, Cambridge Univ. Press, ISBN 978-0521689175 - Rupert Patzelt, Herbert Schweinzer, #Elektrische Messtechnik#, Springer Verlag 1996, ISBN 978-3211828731 			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Measurement Electronics	2,0	Lecture	german
Literature			
<ul style="list-style-type: none"> • Allan R. Hambley #Electronics#, Prentice Hall • U. Tietze, Ch. Schenk #Halbleiter-Schaltungstechnik#, Springer-Verlag, 2002 • Dieter Nührmann #Das komplette Werkbuch Elektronik#, Franzis-Verlag • P. Horowitz #The Art of Electronics#, Cambridge Univ. Press • Rupert Patzelt, Herbert Schweinzer, #Elektrische Messtechnik#, Springer Verlag 1996 			
Measurement Electronics	1,0	Exercise	german
Literature			
<ul style="list-style-type: none"> • Allan R. Hambley #Electronics#, Prentice Hall • U. Tietze, Ch. Schenk #Halbleiter-Schaltungstechnik#, Springer-Verlag, 2002 • Dieter Nührmann #Das komplette Werkbuch Elektronik#, Franzis-Verlag • P. Horowitz #The Art of Electronics#, Cambridge Univ. Press • Rupert Patzelt, Herbert Schweinzer, #Elektrische Messtechnik#, Springer Verlag 1996 			

Title	Data Bus Systems		
Number	2412400	Module version	
Shorttext	ET-IFR-40	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	3 / 5,0	Module owner	Prof. Dr. Markus Maurer
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	oral exam (30 minutes) or written exam (60 minutes), depending on the number of participants		
Course achievement			
Contents			
<ul style="list-style-type: none"> - Bus architectures and access methods - Physical layers - Network and transport layer according to ISO layer model using the example of the OSEK standard for Network communication and management - LIN, CAN, TTP, FlexRay, MOST and Bluetooth - Interbus, Profibus, HART, ASI - Procedure for the selection of a suitable data bus system for a selected application 			
Objective qualification			
After completing this module, students have basic knowledge of architectures and protocol standards of data bus systems in modern motor vehicles as well as industrial plants. They are familiar with functional principles and properties of commonly used data buses from various application areas. The fundamentals learned enable them to independently design or analyze and evaluate networked systems.			
Literature			
<ul style="list-style-type: none"> - Zimmermann, Schmidgall, Bussysteme in der Fahrzeugtechnik, Vieweg Verlag 2006, ISBN 3-8348-0166-6 - G. Schnell, B. Wiedemann, Bussysteme in der Automatisierungs- und Prozesstechnik, Vieweg Verlag 2006, ISBN 3-8348-0045-7 			

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Related courses			
Rules for the choice of courses			
both lectures and exercises must be attended			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language

	2,0	Lecture	german
Literature			
<ul style="list-style-type: none">- Foliensammlung- Literaturempfehlungen in der Vorlesung- Etschberger, Controller-Area-Network, Hanser Verlag- Grzempa: LIN-Bus, Franzis Verlag- Rausch: Flexray, Hanser Verlag- Schäuffele: Automotive Software Engineering, Vieweg Verlag- Zimmermann: Bussysteme in der Fahrzeugtechnik, Vieweg Verlag- Schnell, Wiedemann: Bussysteme in der Automatisierungs- und Prozesstechnik			
	1,0	Exercise	german

Title	Automotive Systems Engineering		
Number	2412660	Module version	
Shorttext	ET-IFR-66	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	4 / 5,0	Module owner	Prof. Dr. Markus Maurer
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	written exam (60 minutes) or oral exam (30 minutes)		
Course achievement			
Contents			
<ul style="list-style-type: none"> - architectures in vehicle development - development processes for complex automotive systems - simulation, test and development methods for complex automotive systems - safety requirements and concepts - software components and architectures - formal description methods - examples from driver assistance and electric mobility 			
Objective qualification			
<p>Handling complexity in the development and production process is one of the core competencies of today's car manufacturers. After completing this module, students will have an overview of established and innovative methods for handling complexity in vehicle development. They learn about architectures, methods for requirements management, processes, description methods as well as test, simulation and development tools for vehicle development.</p> <p>After completing this module, students will be able to analyze and enhance existing processes, and development and test methods in companies. Students become capable to design innovative automotive systems.</p> <p>Special attention will be paid to the safety of the systems during the design activities. For given tasks, they learn to derive requirements for the systems systematically.</p>			
Literature			
<ul style="list-style-type: none"> • J. Schäuffele, T. Zurawka: Automotive Software Engineering, Vieweg Verlag, ISBN: 978-3834800510 • Maurer, Markus, et al. Autonomous driving: technical, legal and social aspects. Springer Nature, 2016. • Schröder, Tobias, et al. "Compensating for the Absence of a Required Accompanying Person: A Draft of a Functional System Architecture for an Automated Vehicle." 2021 IEEE International Intelligent Transportation Systems Conference (ITSC). IEEE, 2021. • Nolte, Marcus, et al. "Supporting Safe Decision Making Through Holistic System-Level Representations & Monitoring--A Summary and Taxonomy of Self-Representation Concepts for Automated Vehicles." arXiv preprint arXiv:2007.13807 (2020). • Jatzkowski, Inga, et al. "A Knowledge-based Approach for the Automatic Construction of Skill Graphs for Online Monitoring." 2021 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2021. 			

- Graubohm, Robert, et al. "Towards efficient hazard identification in the concept phase of driverless vehicle development." 2020 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2020.
- Stolte, Torben, et al. "Towards Safety Concepts for Automated Vehicles by the Example of the Project UNICARagil." 29th Aachen Colloquium Sustainable Mobility 2020, 5.–7. Oktober 2020. 2020.
- Menzel, Till, et al. "From functional to logical scenarios: Detailing a keyword-based scenario description for execution in a simulation environment." 2019 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2019.
- Nolte, Marcus, et al. "Representing the Unknown–Impact of Uncertainty on the Interaction between Decision Making and Trajectory Generation." 2018 21st International Conference on Intelligent Transportation Systems (ITSC). IEEE, 2018.
- Bagschik, Gerrit, et al. "A system's perspective towards an architecture framework for safe automated vehicles." 2018 21st International Conference on Intelligent Transportation Systems (ITSC). IEEE, 2018.
- Menzel, Till, Gerrit Bagschik, and Markus Maurer. "Scenarios for development, test and validation of automated vehicles." 2018 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2018.
- Matthaei, Richard, and Markus Maurer. "Functional system architecture for an autonomous on-road motor vehicle." Automotive Systems Engineering II. Springer, Cham, 2018. 93-120.
- Stolte, Torben, et al. "Hazard analysis and risk assessment for an automated unmanned protective vehicle." 2017 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2017.
- Ulbrich, Simon, et al. "Defining and substantiating the terms scene, situation, and scenario for automated driving." 2015 IEEE 18th international conference on intelligent transportation systems. IEEE, 2015.

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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
Literature			
Markus Maurer (Hrsg), Hermann Winner (Hrsg): Automotive Systems Engineering, Springer Verlag, 2013 J. Schäuffele, T. Zurawka: Automotive Software Engineering, Vieweg Verlag, ISBN: 978-3834800510			
	2,0	Exercise	german
Literature			
Markus Maurer (Hrsg), Hermann Winner (Hrsg): Automotive Systems Engineering, Springer Verlag, 2013 J. Schäuffele, T. Zurawka: Automotive Software Engineering, Vieweg Verlag, ISBN: 978-3834800510			

Title	Integrated Circuits		
Number	2413280	Module version	
Shorttext	ET-IHT-28	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	3 / 5,0	Module owner	Prof. Dr. Vadim Issakov
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	oral exam (20 min)		
Course achievement			
Contents			
<p>The module provides an overview of the operation, design, and technology of integrated electronic circuits in microelectronics.</p> <ul style="list-style-type: none"> • Introduction • Basic digital circuits • MOS and CMOS • Silicon wafer manufacturing • MOSFET process technology • Nanolithography • Etching techniques and oxidation • Design automation, design rules, and assembly techniques • Back-end technologies • Modern developments: Memory technologies 			
Objective qualification			
<p>After completing the module, students will be able to understand integrated circuits, their structure and mode of operation and design simple integrated circuits themselves. A further focus is on the methods of nanotechnology.</p>			
Literature			
<p>Lecture slides and short script J.M.Rabaey, A.Chandrakasan, B. Nikolic, Digital Integrated Circuits Prentice Hall Electronics and VLSI Series, 2002 ISBN: 8120322576 A. Schlachetzki, Integrierte Schaltungen, Teubner, 1978, (as copy at IHT) ISBN: 3-519-03070-5 D. Widmann, H. Mader, H. Friedrich, Technologie Hochintegrierte Schaltungen, Springer, 1996 ISBN:3540593578 W. Prost, Technologie der III/V Halbleiter, Springer, 1997 ISBN: 3540628045</p>			

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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
Literature			
Vorlesungsfolien und Kurzschrift K.-H. Cordes, A. Waag, N. Heuck : Integrierte Schaltungen; Pearson Studium, 2010 J.M.Rabaey, A.Chandrakasan, B. Nikolic, Digital Integrated Circuits Prentice Hall Electronics and VLSI Series, 2003, 1996 A. Schlachetzki, Integrierte Schaltungen, Teubner, 1978, (als Kopie im IHT) D. Widmann, H. Mader, H. Friedrich, Technologie Hochintegrierte Schaltungen, Springer, 1996 W. Probst, Technologie der III/V # Halbleiter, Springer, 1997			
	1,0	Exercise	german
Literature			
K.-H. Cordes, A. Waag, N. Heuck : Integrierte Schaltungen; Pearson Studium, 2010			

Title	Lighting Engineering		
Number	2413320	Module version	
Shorttext	ET-IHT-32	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Andreas Waag
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	oral exam (30 min) or written exam (90 min)		
Course achievement			
Contents			
<p>The module provides an overview of lighting technology, from the physical principles of light and lighting to the manufacture of light sources, luminaires and the relevant DIN standards. Special focus: Lighting technology and lighting technology for the automotive sector</p> <ul style="list-style-type: none"> • Introduction and overview • The nature of light: physical principles • The human perception of light • Production and design of light sources • Module structure • Energy balances • Standardisation • Applications (lighting technology, Automotive Lighting) <p>[Lighting technology (V)] The module provides an overview of lighting technology, from the physical principles of light and lighting to the manufacture of light sources and luminaires. After completing the module, students will be able to characterise light sources and illuminants, optimise their efficiency and solve simple lighting technology problems with the help of their parameters.</p> <p>[Lighting technology (Ü)]</p> <ul style="list-style-type: none"> • Introduction and overview • The nature of light: physical principles • The human perception of light • Production and construction of light sources • Module structure • Energy balances • Standardisation 			
Objective qualification			

After completing the module, students will be able to characterise light sources and illuminants, optimise their efficiency and solve simple lighting technology problems with the help of their parameters.

Literature

Lecture notes and slides

Hans-Jürgen Hentschel (Hrsg.): Licht und Beleuchtung; Hüthig 2002, ISBN 3-7785-2817-3

Horst Lange (Hrsg.): Handbuch für Beleuchtung; Landsberg 2007, ISBN 978-3-609-75390-4

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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
Literature			
Vorlesungsfolien und Kurzsript Hans-Jürgen Hentschel: Licht und Beleuchtung Horst Lange: Handbuch für Beleuchtung			
	1,0	Exercise	german

Title	Lighting Engineering with Experiments		
Number	2413590	Module version	
Shorttext	ET-IHT-59	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	5 / 7,0	Module owner	Prof. Dr. Andreas Waag
Workload (h)	210		
Class attendance (h)	70	Self studying (h)	140
Compulsory requirements			
Expected performance/ Type of examination	oral exam (30 min) or written exam (90 min)		
Course achievement	Lab work		
Contents			
<p>The module provides an overview of lighting technology, from the physical principles of light and lighting to the manufacture of light sources, luminaires and the relevant DIN standards. Special focus: Lighting technology and lighting technology for the automotive sector</p> <ul style="list-style-type: none"> • Introduction and overview • The nature of light: physical principles • The human perception of light • Production and design of light sources • Module structure • Energy balances • Standardisation • Applications (lighting technology, Automotive Lighting) <p>[Lighting technology (V)] The module provides an overview of lighting technology, from the physical principles of light and lighting to the manufacture of light sources and luminaires. After completing the module, students will be able to characterise light sources and illuminants, optimise their efficiency and solve simple lighting technology problems with the help of their parameters.</p> <p>[Lighting technology (Ü)]</p> <ul style="list-style-type: none"> • Introduction and overview • The nature of light: physical principles • The human perception of light • Production and construction of light sources • Module structure • Energy balances • Standardisation 			
Objective qualification			

After completing the module, students will be able to characterise light sources and illuminants, optimise their efficiency and solve simple lighting technology problems with the help of their parameters.

Literature

Lecture notes and slides

Hans-Jürgen Hentschel (Hrsg.): Licht und Beleuchtung; Hüthig 2002, ISBN 3-7785-2817-3

Horst Lange (Hrsg.): Handbuch für Beleuchtung; Landsberg 2007, ISBN 978-3-609-75390-4



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
Literature			
Vorlesungsfolien und Kurzsript Hans-Jürgen Hentschel: Licht und Beleuchtung Horst Lange: Handbuch für Beleuchtung			
	1,0	Exercise	german
Laboratory practical course indoor lighting	2,0	Laboratory	german
Literature			
DIN 5035-5			

Title	Electrical Machines and Drives		
Number	2414180	Module version	
Shorttext	ET-IMAB-18	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	4 / 5,0	Module owner	Prof. Dr. Markus Henke
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 minutes) or oral exam (30 minutes)		
Course achievement			
Contents			
<ul style="list-style-type: none"> - Speed and torque control of direct current and three-phase drives with power electronic control circuits - Operating behaviour of permanent magnet and salient pole synchronous machines - Modelling of electrical machines and drives - Design and control of magnetic bearings 			
Objective qualification			
After completing the Electrical Drives module, students will have an overview of the functions of the most important DC and most important direct current and rotating field machines. The in-depth fundamentals enable the assessment of existing motor and generator drives as well as the design of simple drive systems for industry and mobile applications.			
Literature			
Binder, Elektrische Maschinen und Antriebe: Grundlagen, Betriebsverhalten, Springer Schröder D., Elektrische Antriebe Grundlagen, Springer Hofmann W., Elektrische Maschinen, Pearson Hagl, Elektrische Antriebstechnik, Hanser			

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

	2,0	Exercise	german
Literature			
Skript			
	2,0	Lecture	german
Literature			
Skript, H.O. Seinsch, Ausgleichsvorgänge bei elektrischen Antrieben, Teubner Verlag, Stuttgart			

Title	basic circuits of power electronics		
Number	2414190	Module version	
Shorttext	ET-IMAB-19	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	4 / 5,0	Module owner	Prof. Dr. Regine Mallwitz
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 min) or oral exam (30 min)		
Course achievement			
Contents			
<ul style="list-style-type: none"> • Components of power electronics • Simulation of power electronics • Dimensioning of chokes and transformers • Functionality and design of DC converters and switching power supplies • Control and protective circuitry of power semiconductors • Power loss and cooling of power semiconductors 			
Objective qualification			
After completing the module, students will have acquired basic knowledge of the structure, function, application and design of passive components in power electronics. They will be able to independently design and dimension complete power electronics circuit arrangements.			
Literature			
Schaltnetzteile und ihre Peripherie, Ulrich Schlienz, Vieweg-Verlag			

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

	2,0	Lecture	german
Literature			
Jürgen Meins: "Elektromechnik", B.G. Teubner Verlag 1997 Schaltnetzteile und ihre Peripherie, Ulrich Schlienz, Vieweg-Verlag			

Title	Optical Communications with Lab		
Number	2415220	Module version	
Shorttext	ET-IHF-22	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	4 / 6,0	Module owner	Prof. Dr. Thomas Schneider
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 minutes) or oral exam (30 minutes)		
Course achievement			
Contents			
<ul style="list-style-type: none"> - Optical fibers - Dispersion, velocities of light - Coherent modulation - Coherent receiver - Laser - Optical amplifier - Optoelectronic modulators - Photodetectors - Systems of optical communications 			
Objective qualification			
After completing the module, the students understand the mode of operation and know the performance characteristics of different components of optical transmission links. They can design and dimension fibre-optic transmission links.			
Literature			
S. L. Chuang, Physics of Photonic Devices, Wiley & Sons, ISBN 9780470293195			

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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
Literature			
- Skript zur Vorlesung - S. L. Chuang, Physics of Optoelectronic Devices, John Wiley & Sons			
	1,0	Exercise	german
	1,0	Laboratory	english
Literature			
Skript zum Praktikum			

Title	Dielectric materials for electronics and photonics		
Number	2415250	Module version	
Shorttext	ET-IHF-25	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	3 / 5,0	Module owner	Prof. Dr. Wolfgang Kowalsky
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 min) or oral exam (30 min) or presentation		
Course achievement			
Contents			
<ul style="list-style-type: none"> - Crystalline solids - Reciprocal lattice - X-ray deflection - Phonons - Dielectric properties of insulators (local electric field, mechanisms of polarization, Kramers-Kronig relations) - Thermal properties of insulators (Specific heat, thermal expansion, thermal conductivity) - Magnetic properties of diamagnetism and paramagnetism - Ferro-, antiferro-, and ferrimagnetism 			
Objective qualification			
After completion of the module students have deeper understanding of solid state physics of dielectrics, semiconductors, and metals. They developed the capability to design electronic and optoelectronic devices.			
Literature			
<ul style="list-style-type: none"> - Skript zur Vorlesung - N. W. Ashcroft, N. D. Mermin, Solid State Physics, Thompson Press, ISBN 8131500527 - C. Kittel, Einführung in die Festkörperphysik, Oldenbourg, ISBN 3486577239 			

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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
Literature			
- Skript zur Vorlesung - N. W. Ashcroft, N. D. Mermin, Solid State Physics, Harcourt School - C. Kittel, Einführung in die Festkörperphysik, Oldenbourg			
	1,0	Exercise	german

Title	Microwave Systems and Circuits		
Number	2415390	Module version	
Shorttext	ET-IHF-39	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Jörg Schöbel
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	written exam (90 minutes) or oral exam (30 minutes) or homework or semester project		
Course achievement			
Contents			
<ul style="list-style-type: none"> - radio transmission systems, system concepts and components - system/link budget, noise, nonlinear distortion - oscillators, phase noise, PLL - introduction to microwave circuits, Smith chart, matching structures - passive components: couplers, SAW filters, ferrites (isolators, circulators) 			
Objective qualification			
<p>After completing the module, students have an overview of systems and components in radio transmission systems as well as a basic understanding of the associated RF circuits. They have gained basic experience in the design of transmission systems and of exemplary components using commercial design software. They are also familiar with the most important characterisation methods and have the basic skills to specify and to design transmission systems and their components.</p>			
Literature			
Pozar, Microwave Engineering, Wiley, ASIN B001QA4I9C Unger, Harth, Hochfrequenz-Halbleiterelektronik, Hirzel, ISBN 3777602353			

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

	2,0	Exercise	german
	2,0	Lecture	german

Title	Linear photonics with practical course		
Number	2415500	Module version	
Shorttext	ET-IHF-50	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	6 / 8,0	Module owner	Prof. Dr. Thomas Schneider
Workload (h)	240		
Class attendance (h)	84	Self studying (h)	156
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 min) or oral exam (30 min)		
Course achievement	Lab work		
Contents			
Ray optics, wave optics, Fourier optics, electromagnetic optics, quantum optics with practical experiments on: lenses, imaging, refraction, diffraction, interferometers, determination of optical constants, polarisation, Fourier optics, holography, laser, waveguide optics, quantum optics.			
Objective qualification			
After completing the module, the students know the essential fundamentals of modern photonics and can apply this knowledge to the assessment, design and simulation of photonic systems. Through the practical experiments offered, the students gain additional practical experience.			
Literature			
B.E.A. Saleh, M.C. Teich, Fundamentals of Photonics, (Wiley Series in Pure and Applied Optics)			

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

	2,0	Internship	german
Literature			
B.E.A. Saleh, M.C. Teich, Fundamentals of Photonics, (Wiley Series in Pure and Applied Optics)			

Title	Linear Photonics		
Number	2415510	Module version	
Shorttext	ET-IHF-51	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Thomas Schneider
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 min) or oral exam (30 min)		
Course achievement			
Contents			
Ray optics, wave optics, Fourier optics, electromagnetic optics, quantum optics with practical experiments on: lenses, imaging, refraction, diffraction, interferometers, determination of optical constants, polarisation, Fourier optics, holography, laser, waveguide optics, quantum optics.			
Objective qualification			
After completing the module, the students know the essential basics of modern photonics and are thus able to assess photonic and optical systems and technologies.			
Literature			
B. E. A. Saleh, M. C. Teich #Fundamentals of Photonics# John Wiley & Sons			

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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	Computer Architecture		
Number	2416010	Module version	
Shorttext	ET-IDA-01	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	4 / 6,0	Module owner	Prof. Dr. Selma Saidi
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 minutes) or oral exam (30 minutes)		
Course achievement			
Contents			
<ul style="list-style-type: none"> • Introduction to computer architecture • Principles of computer architecture (control, pipelining, memory hierarchy) • Microprocessors (RISC, ISC) • Quantitative computer design • Design of instruction sets 			
Objective qualification			
Students have basic knowledge of modern computer architectures and an understanding of the function of modern computers. With the knowledge they have acquired, they are able to configure computer systems on a component basis and evaluate their performance.			
Literature			
D. Patterson, J. L. Hennessy, Computer Organization and Design #– The Hardware/Software Interface, Morgan Kaufmann Publishers, ISBN 978-0-12-370606-5 # W. Stallings, Computer Organization & Architecture, 6. Edition, Prentice Hall, ISBN-13: 978-0-13-035119-7 # Lecture notes			

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

Technische Universität Braunschweig | Module Guide: Industrial Engineering Specialized in Electrical Engineering (Bachelor)

	1,0	Exercise	german
	3,0	Lecture	german

Title	Communication Networks for Engineers		
Number	2416490	Module version	
Shorttext	ET-IDA-49	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	3 / 5,0	Module owner	Prof. Dr. Admela Jukan
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 minutes) or oral exam (30 minutes)		
Course achievement			
Contents			
<ul style="list-style-type: none"> * Basic network topologies and protocol architectures * Transmission systems and multiplexing methods * Selected protocol mechanisms * LAN protocols * Basics of the Internet and the IP protocol * Routing in the Internet * The TCP protocol and its performance evaluation * High-speed networks (MPLS, Ethernet and optical networks) * Network security 			
Objective qualification			
After completing this module, students have basic knowledge of architectures and protocol standards of communications networks and are familiar with the principles of signalling. The acquired fundamentals enable them to analyze and evaluate new protocols and switching technology procedures.			
Literature			
<p>W. Stallings, Data and Computer Communications, Pearson Prentice Hall, 2004, ISBN: 0-13-183311-1 #</p> <p>B. Mukherjee, Optical WDM networks, Springer, 2006, ISBN: 0-387-29055-9 #</p> <p>J. F. Kurose und K. W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Addison Wesley, 2005, ISBN: 0-321-26976-4</p>			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	1,0	Exercise	german
Literature			
* Skript * J.F. Kuruse und K.W. Ross, Computernetze *W. Stallings, Data and Computer Communications			
	2,0	Lecture	german
Literature			
* Skript * J.F. Kuruse und K.W. Ross, Computernetze *W. Stallings, Data and Computer Communications			

Title	Computer Architecture Basics and Lab		
Number	2416620	Module version	
Shorttext	ET-IDA-62	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	8 / 10,0	Module owner	Prof. Dr. Rolf Ernst
Workload (h)	300		
Class attendance (h)	112	Self studying (h)	188
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 minutes) or oral exam (30 Minutes)		
Course achievement	Lab course		
Contents			
<p>Introduction to computer architecture Principles of computer architecture (control, pipelining, memory hierarchy) Microprocessors (RISC, ISC) Quantitative computer design and design of instruction sets Practical experiments in the following areas Metrological investigation of line effects and synchronisation methods Assembler and automaton implementation on microcontrollers Circuit design using hardware design languages Circuit synthesis</p>			
Objective qualification			
<p>The students have basic knowledge of modern computer architectures and an understanding of the function of modern computers. With the knowledge they have acquired, they are able to configure computer systems on a component basis and evaluate their performance. In the Lab course, students will be able to design simple circuits and embedded software and evaluate the result in terms of its logical and temporal behaviour by means of measurements or simulation. They will be able to formulate and implement a hardware design in a design language and gain an overview of the phases of a complex hardware design. In accordance with the didactic concept of the course and the design of the individual components, interdisciplinary skills are taught and practised. In the context of papers, colloquia and final presentations, these include scientific writing and documentation, dialogue and presentation techniques as well as teamwork in the laboratory or project.</p>			
Literature			
<ul style="list-style-type: none"> -# Computer Organization and Design - The Hardware/Software Interface, 3rd edition, David A. Patterson and John L. Hennessy - Lecture / lab notes 			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	1,0	Exercise	german
	4,0	Internship	german
	4,0	Internship	german
	3,0	Lecture	german

Title	Embedded Computing Systems		
Number	2416630	Module version	
Shorttext	ET-IDA-63	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	2	Institution	
Hours per Week / ECTS	8 / 10,0	Module owner	Prof. Dr. Rolf Ernst Prof. Dr. Selma Saidi
Workload (h)	300		
Class attendance (h)	112	Self studying (h)	188
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 minutes) or oral exam (30 minutes)		
Course achievement	Lab course		
Contents			
<ul style="list-style-type: none"> • Introduction to computer architecture • Principles of computer architecture (control, pipelining, memory hierarchy) • Microprocessors (RISC, ISC) • Quantitative computer design and design of instruction sets • Practical experiments from the following areas • Construction of an Application Specific Instruction Set Processor (ASIP) • Hardware design with a hardware description language (VHDL) • Programming / extension of the software for the ASIP (C) • Hardware / software co-design • Implementation of applications on an ASIP. 			
Objective qualification			
<p>The students have basic knowledge of modern computer architectures and an understanding of the function of modern computers. With the knowledge they have acquired, they are able to configure computer systems on a component basis evaluate their performance.</p> <p>In the Embedded Processors lab course, students learn about the areas of application and utilization potential of Application Specific Instruction Set Processors (ASIPs). They are then able to break down larger tasks into sub-problems and solve them in teamwork. They will have mastered the competent use of complex tools and design processes for hardware and software design.</p> <p>In accordance with the didactic concept of the course and the design of the individual components, interdisciplinary qualifications are taught and practised. In the context of papers, colloquia and final presentations, these include scientific writing and documentation, dialogue and presentation techniques as well as teamwork in the laboratory or project.</p>			
Literature			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	1,0	Exercise	german
	3,0	Lecture	german
	4,0	Internship	german

Title	Communication Networks for Engineers		
Number	2416710	Module version	
Shorttext	ET-IHF-22	Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	2	Institution	
Hours per Week / ECTS	6 / 8,0	Module owner	Prof. Dr. Admela Jukan
Workload (h)	240		
Class attendance (h)	84	Self studying (h)	156
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
#Skript			
J. F. Kurose und K. W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Addison Wesley, 2005, ISBN: 0-321-26976-4			
W. Stallings, Data and Computer Communications, Pearson Prentise Hall, 2004, ISBN: 0-13-183311-1			
L. L. Peterson und B. S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann Publishers, 2003, ISBN: 1-55860-833-8			
J. Liebeherr und M. El Zarki, : Mastering Networks -An Internet Lab Manual- , Pearson, 2004, ISBN: 0-201-78134-4			

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

	5,0	Internship	german
Literature			
J. Liebeherr und M. El Zarki, : Mastering Networks -An Internet Lab Manual-, Pearson, 2004, ISBN: 0-201-78134-4			
	1,0	Exercise	german
Literature			
* Skript * J.F. Kuruse und K.W. Ross, Computernetze *W. Stallings, Data and Computer Communications			
	2,0	Lecture	german
Literature			
* Skript * J.F. Kuruse und K.W. Ross, Computernetze *W. Stallings, Data and Computer Communications			

Title	Fundamentals of Communication Networks		
Number	2416790	Module version	
Shorttext	ET-IDA-79	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	7 / 9,0	Module owner	Prof. Dr. Admela Jukan
Workload (h)	270		
Class attendance (h)	98	Self studying (h)	172
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 minutes) or oral exam (30 minutes)		
Course achievement	Laboratory practical exercises (§ 4 Para. 14)		
Contents			
<p>Basic network structures and protocol architectures Transmission systems and multiplexing methods Selected protocol mechanisms LAN Protocols Basics of the Internet and the IP protocol Routing protocols and algorithms The TCP protocol and its performance evaluation Basics of network security New network architectures and protocols (SDN, MPLS)</p> <p>Practical experiments from one of the two areas:</p> <p>Internet protocols with emphasis on: Single-segment IP networks and statistical routing Dynamic routing protocols RIP, OSPF and BGP Transport protocols UDP and TCP</p> <p>IoT networks and systems with the following focus: Basics of sensors, microcontrollers and Linux OS Basics of network and WiFi access protocols. The Message Queuing Telemetry Transport Protocol (MQTT) Local Data Processing (Fog Computing) for IoT Devices Remote data processing (cloud computing) using HTTP+REST</p>			
Objective qualification			
<p>After completing this module, students have basic knowledge of architectures, protocol standards and theoretical aspects of telecommunication networks as well as computer networks and are familiar with the principles of signalling. The fundamentals learnt enable them to design, analyze and evaluate new protocols and switching procedures.</p> <p>In the practical lab course Communication Networks and System, the students acquire basic practical knowledge of the protocols and algorithms used on the Internet. The students are able to configure proto-</p>			

cols. They are familiar with tools for analyzing real-world network traffic and are able to use these tools to verify the functionality and performance of protocols.

In the practical lab course Design of IoT Networks and Systems, students acquire basic practical knowledge of the design of new network technologies, network systems and protocols from the areas of the Internet of Things (IoT) and cloud computing.

Internet of Things (IoT) and cloud applications together with their integrated application. The students are able to solve problem-specific tasks and integrate them in teamwork into a IoT use case. They know hardware and software tools for analyzing IoT-specific applications and are able to evaluate and verify their functionality.

Literature

Lecture notes #

J. F. Kurose und K. W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Addison Wesley, 2005, ISBN: 0-321-26976-4 #

W. Stallings, Data and Computer Communications, Pearson Prentise Hall, 2004, ISBN: 0-13-183311-1 #

L. L. Peterson und B. S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann Publishers, 2003, ISBN: 1-55860-833-8

J. Liebeherr und M. El Zarki,: Mastering Networks -An Internet Lab Manual-, Pearson, 2004, ISBN: 0-201-78134-4



Related courses

Rules for the choice of courses

One of the two labs must be taken.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
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	4,0	Internship	german
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Literature

J. Liebeherr und M. El Zarki,: Mastering Networks -An Internet Lab Manual-, Pearson, 2004, ISBN: 0-201-78134-4

	1,0	Exercise	german
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Literature

* Skript * J.F. Kuruse und K.W. Ross, Computernetze *W. Stallings, Data and Computer Communications

	2,0	Lecture	german
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Literature

* Skript * J.F. Kuruse und K.W. Ross, Computernetze *W. Stallings, Data and Computer Communications

	5,0	Internship	english
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Title	Electromagnetic Compatibility		
Number	2419120	Module version	
Shorttext	ET-IEMV-12	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	3 / 5,0	Module owner	Dr. Harald Spieker
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	Written exam (60 min) or oral exam (30 min)		
Course achievement			
Contents			
<ul style="list-style-type: none"> • Terms and definitions of EMC • Sources of interference and disturbance variables, immunity of susceptible devices # • Coupling mechanisms: galvanic, capacitive, inductive coupling, wave and radiation interference # • Establishing of EMC by measures at the sources of interference, at the coupling paths and at the susceptible devices; shielding, overvoltage and overcurrent protection # • Legal basis, product liability, standardization # • EMC test engineering # • Electromagnetic compatibility of biological systems 			
Objective qualification			
<p>The students are able to analyze mutual interference and interaction scenarios for electrotechnical and electronic systems and components by emitted interference levels and susceptibilities. The students are able to choose appropriate protection and compatibility measures. The students are able to predict EMC-aspects for the design of facilities and systems at an early stage, as well as to decide on cost-efficient solutions. The students are able to describe the responsibilities for the EMC product safety by the state of standards. The students are able to assess the EMC product safety by failure mechanisms.</p>			
Literature			
<ul style="list-style-type: none"> - Lecture notes - Joachim Franz, EMV – Störungssicherer Aufbau elektronischer Schaltungen, Teubner, 2002, ISBN 3-519-00397-X - Clayton R. Paul, Introduction to Electromagnetic Compatibility, Wiley, 2006, ISBN 0-471-75500-1 - Kenneth L. Kaiser, Electromagnetic Compatibility Handbook, CRC Press, 2005, ISBN 0-8493-2087-9 			

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Related courses			
Rules for the choice of courses			
Either this module or "Electromagnetic Compatibility with Seminar" can be selected.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Electromagnetic Compatibility	2,0	Lecture	german
Electromagnetic Compatibility	1,0	Exercise	german

Title	Lab Course for Circuit Design		
Number	2420130	Module version	
Shorttext	ET-BST-13	Language	german
Frequency of offer	irregular	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	
Workload (h)	150		
Class attendance (h)	70	Self studying (h)	80
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement	Colloquium/lab journal as proof of achievement		
Contents			
<p>Lab Circuit Design: In the exercise, the necessary theoretical knowledge of the homodyne receiver to be set up in the laboratory is acquired. In the laboratory, a homodyne receiver (direct conversion receiver) for the 20m shortwave amateur radio band is completely constructed from discrete components. This receiver architecture, which does not require an intermediate frequency, is used in many modern mobile radio receivers (GSM, UMTS, WLAN, BLUETOOTH). The receiver consists of the following stages: Input amplifier, mixer, oscillator, baseband filter, AF preamplifier, and AF power amplifier. All stages are modeled one after the other using various modern circuit simulators, built discretely on a circuit board and carefully measured. The functionality of the overall circuit is demonstrated in detail in the final experiment.</p> <p>Lab PSpice: In the exercise, the application of the simulator with its various types of analysis is presented. Basic circuits (source, gate and drain circuits), CMOS circuits such as cascode, differential amplifier, current mirror and simple operational amplifier circuits are dealt with in the laboratory. In recent decades, PSPICE has developed into an industrial standard tool for circuit simulation, which is used in the design of analog circuits. The transistor models required for simulation, which are kindly provided by the IHP Leibnitz Institute in Fankfurt/Oder, correspond to a real 0.25um technology from Motorola.</p>			
Objective qualification			
<p>Lab Circuit Design: The students know how to set up, simulate and test a shortwave homodyne receiver.</p> <p>Lab PSpice: Students can carry out circuit simulations with transistor models commonly used in industry on the basis of PSpice, closely following the content of the lecture "Circuit design". The simulation results in a better insight of the circuits and enables the investigation of important effects of real circuits that can no longer be determined by analytical manual calculation.</p>			
Literature			

R. Heinemann: PSpice-Einführung in die Elektroniksimulation, Carl Hanser Verlag München 2001/2003, ISBN 3-446-21656-3

Remark

Usually, the Lab Circuit Design takes place in the winter semester, the Lab PSpice in the summer semester.



Related courses

Rules for the choice of courses

Alternatively:

- Circuit design (Lab + exercise)
- PSpice (Lab + exercise)

The PSpice practical course can be taken parallel to the lecture on circuit design.

Recommendation: Knowledge of the modules "Circuit Theory" and "Circuit Design".

Compulsory attendance

Name of the course	SWS	Eventtype	Language
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	4,0	Internship	german
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	2,0	Exercise	german
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Literature

R. Heinemann: PSPICE - Einführung in die Elektroniksimulation, Carl Hanser Verlag München 2001/2003, ISBN 3-446-21656-3

	2,0	Internship	german
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Literature

R. Heinemann: PSPICE - Einführung in die Elektroniksimulation, Carl Hanser Verlag München 2001/2003, ISBN 3-446-21656-3

	1,0	Exercise	german
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Title	Analog CMOS IC Design		
Number	2420160	Module version	
Shorttext	ET-BST-16	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	4 / 5,0	Module owner	Prof. Dr. Vadim Issakov
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (150 min)		
Course achievement			
Contents			
<p>the most important basic circuits of CMOS technology are introduced and explained and important design criteria for these circuits are developed. Among others, the following circuits are covered:</p> <ul style="list-style-type: none"> - source, gate, and drain circuits with active and passive loads - MOS cascode circuits - differential amplifier circuits - current mirror circuits - voltage and current reference circuits - elementary operational amplifier circuits <p>In addition to the elementary stability analysis of amplifier circuits, the operating point determination (DC analysis) is covered, the small-signal behavior (AC analysis) and, in extracts, the transient large-signal behavior (transient analysis) of the circuits.</p>			
Objective qualification			
After completing the module, students will be familiar with the basic elements and circuit components of CMOS technology and their basic circuit technology. They are familiar with the design of elementary integrated CMOS circuits.			
Literature			
<p>B. Razavi: "Design of Analog Integrated Circuits" McGraw-Hill A.S.Sedra, K.C. Smith: "Microelectronic Circuits" Oxford University Press</p>			

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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	Electrical Distribution Systems Technology		
Number	2423300	Module version	
Shorttext	ET-HTEE-30	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Bernd Engel
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 min)		
Course achievement			
Contents			
<ul style="list-style-type: none"> • Electrical Grid and Grid structures • Basic terms, energy history, future • Cable and overhead line • Transformer • Substations and Control rooms • Grid safety & security • Grid planning, calculation and AI • Grid financing and grid fees • Innovative grid operation using the example of medium and low voltage grids • Active power management in distribution grids 			
Objective qualification			
<p>After successfully completing the module, students will have basic knowledge of technologies that are relevant to the distribution of electrical energy now and in the future. They are informed about current and future developments in electrical energy distribution networks and can formulate existing challenges. They are able to analyse and assess technologies, components and systems and to design and dimension them in principle.</p>			
Literature			
<p>Elektrische Energieverteilung – Flosdorff, Hilgarth – Vieweg + Teubner Elektrische Energieversorgung – Heuck, Dettmann, Schulz – SpringerVieweg Taschenbuch der elektrischen Energietechnik – Schufft – Hanser Elektrische Anlagentechnik – Knies, Schierack – Hanser Elektroenergiesysteme – Schwab – Springer</p>			

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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
Literature			
Elektrische Energieverteilung; Flosdorff, Hilgarth; Vieweg + Teubner Elektrische Energieversorgung; Heuck, Dettmann, Schulz; SpringerVieweg Taschenbuch der elektrischen Energietechnik; Schufft; Hanser Elektrische Anlagentechnik; Knies, Schierack; Hanser Elektroenergiesysteme; Schwab; Springer			
	1,0	Exercise	german
Literature			
Elektrische Energieverteilung; Flosdorff, Hilgarth; Vieweg + Teubner Elektrische Energieversorgung; Heuck, Dettmann, Schulz; SpringerVieweg Taschenbuch der elektrischen Energietechnik; Schufft; Hanser Elektrische Anlagentechnik; Knies, Schierack; Hanser Elektroenergiesysteme; Schwab; Springer			

Title	Electrical Transmission Systems Technology		
Number	2423420	Module version	
Shorttext	ET-HTEE-42	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	4 / 5,0	Module owner	Prof. Dr. Michael Kurrat
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 minutes) or oral exam (30 min)		
Course achievement			
Contents			
<ul style="list-style-type: none"> • High-Voltage Technologies • Smart Grids • High-Voltage Direct Current Transmission • High-Temperature Superconductors 			
Objective qualification			
After successful completion of the course, students have a fundamental understanding of latest and future technologies that are relevant for the transmission of electrical energy. They are informed about current and future developments regarding transmission grids and are able to formulate existing challenges. Students are also able to analyze, assess and design technologies, components, and systems on a fundamental level.			
Literature			
Hochspannungstechnik, A. Küchler, Springer Verlag Elektroenergiesysteme, A. Schwab, Springer Verlag Elektrische Energieversorgung, K. Heuck, Vieweg Grundkurs Leistungselektronik, J. Specovius, Vieweg+Teubner Verlag Supraleitung, W. Buckel, VCH			

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Related courses			
Rules for the choice of courses			
Bachelor's module			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language

	2,0	Exercise	german
	2,0	Lecture	german

Title	Energy Economy and Market Integration of Renewables		
Number	2423460	Module version	
Shorttext	ET-HTEE-42	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	4 / 5,0	Module owner	Prof. Dr. Bernd Engel
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 min) or oral exam (30 min)		
Course achievement			
Contents			
1. energy economics 2. energy policy 3. laws and subsidy systems 4. markets (electricity market 2.0, balancing power market) 5. direct marketing / balancing group management 6. virtual power plant 7. large-scale storage			
Objective qualification			
On completion of the module, students will have acquired knowledge of the energy industry in Germany. They will be able to evaluate and assess current developments in the markets. New technologies and research insights are integrated.			
Literature			
Marcel Linnemann: Energiewirtschaft für (Quer-)Einsteiger Tim Wawer: Elektrizitätswirtschaft			

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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
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Title	Planning of Terrestrial Radio Networks		
Number	2424410	Module version	
Shorttext	ET-NT-41	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Thomas Kürner
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Oral exam (20 minutes) or written exam (90 minutes)		
Course achievement	Colloquium or lab journal		
Contents			
<p>Introduction Radio propagation models Coverage planning Planning cellular networks General principles of cellular network planning GSM radio network planning UMTS radio network planning Planning OFDMA networks</p> <p>As part of the computer exercise, an introduction to the operation and handling of a radio planning tool</p>			
Objective qualification			
<p>After completing the module, students will have an understanding of the essential processes and interrelationships involved in planning terrestrial radio networks and will have acquired knowledge of the data required for this purpose and, in particular, the algorithms, models and methods used. They will be able to solve planning tasks independently using a radio planning tool.</p>			
Literature			
<ul style="list-style-type: none"> • Lecture notes (German and English) • C. Lüders, Mobilfunksysteme, Vogel-Verlag 2001 # • N. Geng, W. Wiesbeck, Planungsmethoden für die Mobilkommunikation, Springer-Verlag 1998 • J. Laiho, A. Wacker, T. Novosad, Radio Network Planning and Optimisation for UMTS, Wiley 2002 			
Remark			
This Master's module is also suitable for Bachelor students.			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Laboratory	german
Literature			
siehe Vorlesung			
	2,0	Lecture	german
Literature			
Skript in deutscher und englischer Sprache C.Lüders, Mobilfunksysteme, Vogel-Verlag 2001 N.Geng, W.Wiesbeck, Planungsmethoden für die Mobilkommunikation, Springer-Verlag 1998 J.Laiho, A.Wacker, T.Novosad, Radio Network Planning and Optimisation for UMTS, Wiley 2002			

Title	Fundamentals of Digital Signal Processing		
Number	2424480	Module version	
Shorttext	ET-NT-48	Language	german
Frequency of offer	every term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Tim Fingscheidt
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 minutes) or oral exam (30 minutes)		
Course achievement			
Contents			
<ul style="list-style-type: none"> - Discrete-time signals and systems # - Fourier transforms # - Z-transforms and applications # - Discrete-time IIR filter design # - Discrete-time FIR filter design # - Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) # - Basics of multi-rate processing and filter banks 			
Objective qualification			
After completing this module, students will have basic knowledge on the tools of digital signal processing in the time and frequency domain and can apply these tools to corresponding problems.			
Literature			
<ul style="list-style-type: none"> - Lecture notes - A.V. Oppenheim, R.W. Schaffer, J.R. Buck: "Zeitdiskrete Signalverarbeitung" , Pearson Verlag, 2004 - K.D. Kammeyer, K. Kroschel: "Digitale Signalverarbeitung" , Teubner Verlag, 2002 - A.V. Oppenheim, R.W. Schaffer, J.R. Buck: "Discrete Time Signal Processing" , Prentice-Hall, 2004 - H.-W. Schüßler: "Digitale Signalverarbeitung 1" , Springer Verlag, 1994 			
Remark			

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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
Literature			
<ul style="list-style-type: none"> • A. V. Oppenheim, R. W. Schafer, J. R. Buck: Zeitdiskrete Signalverarbeitung, Pearson Studium, 2004 • K. D. Kammeyer, K. Kroschel: Digitale Signalverarbeitung, Teubner Verlag, 2002 • A. V. Oppenheim, R. W. Schafer, J. R. Buck: Discrete Time Signal Processing, Prentice Hall, 2004 • H.-W. Schüßler: Digitale Signalverarbeitung, Springer Verlag, 1994 			
	1,0	Exercise	german
Literature			
siehe Vorlesung			

Title	Fundamentals of Mobile Radio Communications		
Number	2424490	Module version	
Shorttext	ET-NT-49	Language	english german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Thomas Kürner
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Oral exam (20 min) or written exam (90 min)		
Course achievement			
Contents			
<ol style="list-style-type: none"> 1. Introduction 2. Wave Propagation 3. Radio Transmission 4. Media Access 5. 3GPP Wireless Systems 6. IEEE 802 Wireless Systems 			
Objective qualification			
The lecture provides the basics in the areas of the air interface of mobile communication systems. Students will acquire knowledge on the structure and functionality of cellular and wireless local area networks.			
Literature			
<ul style="list-style-type: none"> • Lecture notes • C. Lüders, Mobilfunksysteme, Vogel-Verlag 2001 • # J. Schiller, Mobilkommunikation, Addison-Wesley 2000 • N. Geng, W. Wiesbeck, Planungsmethoden für die Mobilkommunikation, Springer-Verlag 1998 # • A. Molisch, Wireless Communications, Addison-Wesley 2005 			
Remark			
This Master's module is also suitable for Bachelor students.			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	1,5	Exercise	english german
Literature			
siehe Vorlesung			
	2,5	Lecture	english german
Literature			
Skript C. Lüders, Mobilfunksysteme, Vogel-Verlag 2001 J. Schiller, Mobilkommunikation, Addison-Wesley 2000 N. Geng, W. Wiesbeck, Planungsmethoden für die Mobilkommunikation, Springer-Verlag 1998 A. Molisch, Wireless Communications, Addison-Wesley 2005			

Title	Digital Signal Transmission		
Number	2424660	Module version	
Shorttext	ET-NT-66	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	6 / 8,0	Module owner	Prof. Dr. Eduard Jorswieck
Workload (h)	240		
Class attendance (h)	84	Self studying (h)	156
Compulsory requirements			
Expected performance/ Type of examination	Written exam (180 minutes) or oral exam (30 minutes), depending on number of participants		
Course achievement			
Contents			
<p>Part I:</p> <ul style="list-style-type: none"> - Deterministic signals in LTI systems - Fourier transform - Discrete signals and systems - Correlation function of deterministic signals - System theory of low-pass and band-pass systems <p>Part II:</p> <ul style="list-style-type: none"> - Statistical signal processing - Multiplexing - Binary transmission with low-pass signals - Binary transmission with band-pass signals - Digital modulation 			
Objective qualification			
The students describe signal processing systems by their impulse response or transfer function. They know the fundamental principles of digital communications systems.			
Literature			
- Proakis, John G., and Masoud Salehi. Digital communications. Vol. 4. New York: McGraw-Hill, 2001.			
Remark			
First half of the summer semester: Digital Signal Transmission I, second half: Digital Signal Transmission II (4+2 SWS / week). Recommended Recommended prerequisite: module Fundamentals of Information Technology.			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
Literature			
Ohm, Lüke: Signalübertragung, Springer-Verlag, ISBN 3-540-67768-2 Reimers: Digitale Fernsehtechnik, 2. Aufl., ISBN 3-540-60945-8			
	2,0	Lecture	german
Literature			
Ohm, Lüke: Signalübertragung, Springer-Verlag, ISBN 3-540-67768-2 Reimers: Digitale Fernsehtechnik, 2. Aufl., ISBN 3-540-60945-8			
	1,0	Exercise	german
Literature			
siehe Vorlesung			
	1,0	Exercise	german
Literature			
siehe Vorlesung			

Title	Electrochemical storages embedded in on-board power systems		
Number	2419000000	Module version	
Shorttext		Language	english
Frequency of offer	only in the winter term	Teaching unit	
Module duration	1	Institution	Institut für Elektromagnetische Verträglichkeit
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Michael Terörde
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	oral exam, 30 minutes or written exam, 90 minutes		
Course achievement			
Contents			
<p>On-board power system topics: On-board power networks of aircraft, automobiles, ships and satellites, protection elements of on-board networks, calculation of simple circuit diagrams, network shapes, simulations of energy systems, power electronic switches in on-board networks.</p> <p>Electrochemical storage systems: batteries, fuel cells, hydrogen as an energy carrier, super capacitors, power to gas concept, thermal behavior and current and voltage characteristics of the storage systems</p>			
Objective qualification			
After completing the module, students will be able to evaluate the integration of different electrochemical energy storage systems in different types of vehicles. They will be able to derive simple electrical equivalent circuit diagrams from vehicle electrical system circuit diagrams and use them to perform calculations with regard to electrical parameters. They will be able to explain details of the design and operation of fuel cells, batteries and double-layer capacitors.			
Literature			
<ul style="list-style-type: none"> • Dicks, Andrew L., and David AJ Rand. Fuel cell systems explained. John Wiley & Sons, 2018. • Hirose, K., Handbook of hydrogen storage: new materials for future energy storage. 2010: John Wiley & Sons 			

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Related courses			
Rules for the choice of courses			
Elective areas: Energy Systems and Drive Technologies/Powertrain, Autonomous Intelligent Systems			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language

Electrochemical storages embedded in on-board power systems	2,0	Lecture	english
Literature			
<ul style="list-style-type: none">• Dicks, Andrew L., and David AJ Rand. Fuel cell systems explained. John Wiley & Sons, 2018.• Hirose, K., Handbook of hydrogen storage: new materials for future energy storage. 2010: John Wiley & Sons			
Electrochemical storages embedded in on-board power systems	1,0	Exercise	english
Literature			
<ul style="list-style-type: none">• Dicks, Andrew L., and David AJ Rand. Fuel cell systems explained. John Wiley & Sons, 2018.• Hirose, K., Handbook of hydrogen storage: new materials for future energy storage. 2010: John Wiley & Sons			

Title	Model Vehicle Design		
Number	2412000000	Module version	
Shorttext	ET-IFR-69	Language	
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1 Semester	Institution	Institut für Regelungstechnik
Hours per Week / ECTS	3 / 5,0	Module owner	Prof. Dr. Markus Maurer
Workload (h)	150		
Class attendance (h)	42	Self studying (h)	108
Compulsory requirements			
Expected performance/ Type of examination	Project work		
Course achievement			
Contents			
<p>In this course, participants are introduced to a selection of processes for manufacturing mechanical and electrical assemblies. In addition, the theoretical principles of project management are explained. After an introduction, the participants independently design a model vehicle with defined functionalities in smaller teams. In addition to time constraints, the available resources and manufacturing processes must be taken into account. The realization of the model vehicles takes place mainly in the institute's own workshop under the instruction of the technical staff. In a concluding event, the participants present their work steps and results.</p>			
Objective qualification			
<p>After completing this module, the participants are familiar with a selection of manual processes for creating mechanical and electrical components. They are also able to independently design and implement a functional assembly, taking into account the available manufacturing processes. Furthermore, the participants are familiar with the basics of project management and have gained practical experience with project implementation in smaller working groups.</p>			
Literature			
Slides and working sheets			

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

	2,0	Seminar	german
	1,0	Internship	german

Title	Design and calculation of DC systems		
Number	2423510	Module version	
Shorttext	ET-IFR-39	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	4 / 5,0	Module owner	Prof. Dr. Michael Kurrat
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Expected performance/ Type of examination	Oral exam (30 minutes) or development and documentation of a computer/software program		
Course achievement			
Contents			
<ul style="list-style-type: none"> - Calculation and design of DC-networks - Operation of DC-networks - Fault detection and localization - Plant engineering - Components for power generation, distribution and storage - Industrial networks, isolated networks, on-board networks 			
Objective qualification			
<p>After successful completion of the module, students will have a basic knowledge of the structure and function of DC- systems. They are familiar with the hazards and the necessary safety measures and regulations in DC-networks. Industrial networks, data centers and on-board networks are typical applications. By means of experiments and simulations, the students learn practical knowledge.</p>			
Literature			
<p>HVDC Technology: An Introduction (Michael Kurrat, TU Braunschweig) HVDC Grids (D. van Hertem) Microgrid: Dynamics and Control (H. Bevrani) Multi-terminal Direct-Current Grids (N.R. Chaudhuri) Urban DC Microgrid: Intelligent Control and Power Flow Optimization Fault detection and diagnosis in engineering systems Fault location on power networks (M.M. Saha) Elektrische Messtechnik: Analoge, digitale und computergestützte Verfahren (R. Lerch)</p>			

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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
Literature			
HVDC Technology: An Introduction (Michael Kurrat, TU Braunschweig) HVDC Grids (D. van Hertem) Microgrid: Dynamics and Control (H. Bevrani) Multi-terminal Direct-Current Grids (N.R. Chaudhuri) Urban DC Microgrid: Intelligent Control and Power Flow Optimization Fault detection and diagnosis in engineering systems Fault location on power networks (M.M. Saha) Elektrische Messtechnik: Analoge, digitale und computergestützte Verfahren (R. Lerch)			
	2,0	Exercise	german
Literature			
HVDC Technology: An Introduction (Michael Kurrat, TU Braunschweig) HVDC Grids (D. van Hertem) Microgrid: Dynamics and Control (H. Bevrani) Multi-terminal Direct-Current Grids (N.R. Chaudhuri) Urban DC Microgrid: Intelligent Control and Power Flow Optimization (Fault detection and diagnosis in engineering systems Fault location on power networks (M.M. Saha) Elektrische Messtechnik: Analoge, digitale und computergestützte Verfahren (R. Lerch)			

Title	Digital Signal Transmission and Computational Experiments		
Number	2424670	Module version	
Shorttext	ET-NT-67	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	Institut für Nachrichtentechnik
Hours per Week / ECTS	8 / 10,0	Module owner	Prof. Dr. Eduard Jorswieck
Workload (h)	300		
Class attendance (h)	112	Self studying (h)	188
Compulsory requirements			
Expected performance/ Type of examination	Oral exam (30 min) or written exam (180 min)		
Course achievement	Colloquium or lab minutes		
Contents			
<p>Part I:</p> <ul style="list-style-type: none"> - Deterministic signals in LTI systems - Fourier transform - Discrete signals and systems - Correlation function of deterministic signals - System theory of low-pass and band-pass systems <p>Part II:</p> <ul style="list-style-type: none"> - Statistical signal processing - Multiplexing - Binary transmission with low-pass signals - Binary transmission with band-pass signals - Digital modulation 			
Objective qualification			
<p>The students describe signal processing systems by their impulse response or transfer function. They know the fundamental principles of digital communications systems. Practical knowledge and examples in computational experiments.</p>			
Literature			
<ul style="list-style-type: none"> - Ohm, Lüke: Signalübertragung, Springer-Verlag, ISBN 3-540-67768-2 - U. Reimers: Digitale Fernsehtechnik, 2.Aufl. 1997, ISBN 3-540-60945-8 			
Remark			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
Literature			
Ohm, Lüke: Signalübertragung, Springer-Verlag, ISBN 3-540-67768-2 Reimers: Digitale Fernsehtechnik, 2. Aufl., ISBN 3-540-60945-8			
	2,0	Laboratory	german
Literature			
siehe Vorlesung			
	2,0	Lecture	german
Literature			
Ohm, Lüke: Signalübertragung, Springer-Verlag, ISBN 3-540-67768-2 Reimers: Digitale Fernsehtechnik, 2. Aufl., ISBN 3-540-60945-8			
	1,0	Exercise	german
Literature			
siehe Vorlesung			
	1,0	Exercise	german
Literature			
siehe Vorlesung			

Title	Application of Control Engineering Methods		
Number	2412000010	Module version	
Shorttext		Language	german
Frequency of offer	only in the winter term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	Institut für Regelungstechnik
Hours per Week / ECTS	4 / 5,0	Module owner	Prof. Dr. Markus Maurer
Workload (h)	150		
Class attendance (h)	56	Self studying (h)	94
Compulsory requirements			
Recommended requirements	Fundamentals of Control Engineering (can be done parallel), max number of participants: 16		
Expected performance/ Type of examination	Written exam (60 min) or oral exam (30 min)		
Course achievement			
Contents			
Modeling, representation in the time and frequency domain, computer-aided solution of differential equations, step responses, impulse responses, Laplace transformation, Bode diagram, locus curve, typical individual elements of controlled systems, transfer function, controller design of standard controllers, equivalent time constant, cascade control, computer-aided tools for control engineering tasks			
Objective qualification			
After completing the module, students will have basic knowledge in the field of linear control engineering as well as in-depth knowledge of the use of computer-aided applications for simulation, controller design and the application of the theoretical content taught. They are familiar with the properties and dynamic behavior of basic control engineering components and methods of classical controller design. They understand the concepts for describing linear and simple non-linear dynamic systems in the time and frequency domain as well as the concept of the Laplace transformation. You will be able to model linear time-invariant systems with concentrated memories and design standard controllers in the frequency domain. This includes the design using pole placement, the modelling of equivalent time constants, as well as working in the Bode diagram and the design of multi-loop controller structures.			
Literature			
Remark			

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

Economic Sciences Specialisation

Title	Specialisation - Services Management		
Number	2201010	Module version	V2
Shorttext	WW-DLM-01	Language	german
Frequency of offer	only in the summer term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Automobilwirtschaft und Industrielle Produktion - Lehrstuhl für Dienstleistungsmanagement
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. David Woitschläger
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 oral exam (30 min) or 1 take-at-home exam		
Course achievement			
Contents			
<ul style="list-style-type: none"> • Characteristics and typologies of services • Customer behaviour in the service process • Quality management • Customer relationship management • Marketing of services 			
Objective qualification			
In this module, students acquire a basic understanding of issues relating to the management of service companies and the marketing of services. Students learn a broad spectrum of methods for analysing business management issues in various service fields.			
Literature			
<ul style="list-style-type: none"> • Zeithaml/Bitner/Gremler (2006): Services Marketing 			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Services Management	4,0	Lecture/Exercise	german
Literature			
<ul style="list-style-type: none"> • Zeithaml/Bitner/Gremler (2006): Service Marketing • Ergänzende Literatur (PDF-Dokumente, Vorlesungsunterlagen zum Download) 			
	2,0	Colloquium	german
Bachelor-/Master-Colloquium Services Management	2,0	Colloquium	german

Title	Specialisation - Economics		
Number	2212110	Module version	V2
Shorttext	WW-VWL-11	Language	german
Frequency of offer	every term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	2	Institution	
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			
Course achievement			
Contents			
Objective qualification			
Literature			
<ul style="list-style-type: none"> • Wellisch, D. (2000): Finanzwissenschaft I, München: Vahlen. • Blanchard, O und G. Illing (2014): Makroökonomie, Halbergmoss. Pearson. • Ray, D (1998): Development Economics, Princeton: Princeton University Press. 			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Development Economics	2,0	Lecture/Exercise	german
Literature			
<ul style="list-style-type: none"> • Todaro, Michael P., Smith, Stephen C.: Economic Development, Pearson, aktuelle Auflage • Weil, David: Economic Growth, Routledge, aktuelle Auflage 			

Economics of the State	2,0	Lecture/Exercise	german
Literature			
<ul style="list-style-type: none"> • Krugman, Paul R., Obstfeld, Maurice, Melitz, Marc: Internationale Wirtschaft, Pearson Studium, aktuelle Auflage • Pindyck, Robert S., Rubinfeld, Daniel L.: Mikroökonomie, Pearson Studium, aktuelle Auflage 			
	2,0	Colloquium	german

Title	Specialisation - Management Accounting		
Number	2214090	Module version	V2
Shorttext	WW-ACuU-09	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	Prof. Dr. Heinz Ahn
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
einführende Literatur: <ul style="list-style-type: none"> • Baden: Strategische Kostenrechnung, Wiesbaden 1997 • Ewert/Wagenhofer: Interne Unternehmensrechnung, Berlin et al., 6. Auflage, 2005 • Kremin-Buch: Strategisches Kostenmanagement, jeweils aktuelle Auflage 			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Cost Accounting Systems	2,0	Lecture	german
Literature			
Ewert, R./Wagenhofer, (2014): Interne Unternehmensrechnung, 8. Aufl., Berlin et al.			

Strategic Cost Management	2,0	Lecture	german
Literature			
Baden, A. (1997): Strategische Kostenrechnung, Wiesbaden			
	1,0	Colloquium	german
	1,0	Colloquium	german
	1,0	Lecture	german
	1,0	Lecture	german
Audit Insights	2,0	Lecture	german

Title	Specialisation - Finance		
Number	2215050	Module version	V2
Shorttext	WW-FIWI-05	Language	
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	
Hours per Week / ECTS	0 / 6,0	Module owner	Prof. Dr. Marc Gürtler
Workload (h)			
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
<ul style="list-style-type: none"> • Breuer (2000): Investitionstheorie I • Breuer (2001): Investitionstheorie II • Breuer (1998): Finanzierungstheorie 			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Corporate Finance	2,0	Lecture	german
Literature			
<ul style="list-style-type: none"> • Breuer, W. (1998): Finanzierungstheorie, Wiesbaden • weitere Literatur siehe Homepage des Lehrstuhls 			

Capital Budgeting	2,0	Lecture	german
Literature			
vergleiche Homepage des Lehrstuhls			
Machine and Statistical Learning in Finance	2,0	Lecture	german
Literature			
<ul style="list-style-type: none"> • James, Gareth/Witten, Daniela/Hastie, Trevor/Tibshirani, Robert (2023): An Introduction to Statistical Learning with Applications in R, 2. Auflage, korrigierte Fassung, Springer. • Heesen, B. (2023): Künstliche Intelligenz und Machine Learning mit R, Springer Fachmedien Wiesbaden. 			
Capital Budgeting and Corporate Finance	2,0	Lecture	german
Literature			
<p>Breuer, Wolfgang (2012): Investition I, 4. Auflage, Wiesbaden.</p> <p>Breuer, Wolfgang (2001): Investition II, Wiesbaden.</p> <p>Breuer, Wolfgang/Christen, Marc/Schubert, Jörg/Praxl, Johannes (1999): Die Bewertung betrieblicher Realoptionen, Berlin.</p> <p>Aufage, Beate, Walther/Witte, Frank (2018): Investitionstheorie und Investitionsrechnung, 5. Auflage, Berlin.</p> <p>Kruschwitz, Lutz/Lorenz, Daniela (2019): Investitionsrechnung, 15. Auflage, Berlin.</p>			
	2,0	Colloquium	german

Title	Specialisation - Law		
Number	2216200	Module version	V3
Shorttext	WW-RW-20	Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	
Hours per Week / ECTS	4 / 6,0	Module owner	
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
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
Spezialisaton Law	4,0	Lecture/Exercise	
Literature			
Löhnig, Martin; Fischinger, Philipp S.: Einführung in das Zivilrecht, aktuelle Auflage, C. F. Müller Musielak, Hans-Joachim; Hau, Wolfgang: Grundkurs BGB, aktuelle Auflage, C. H. BECK Medicus, Dieter; Petersen, Jens: Grundwissen zum Bürgerlichen Recht, aktuelle Auflage, Vahlen Junker, Abbo: Grundkurs Arbeitsrecht, aktuelle Auflage, C. H. BECK Krause, Rüdiger: Arbeitsrecht, aktuelle Auflage, Nomos			

Title	Specialisation - Decision Support		
Number	2218140	Module version	V2
Shorttext	WW-WINFO-14	Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	
Hours per Week / ECTS	4 / 6,0	Module owner	
Workload (h)			
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
<ul style="list-style-type: none"> • Gabriel et al.: Computergestützte Informations- und Kommunikationssysteme in der Unternehmung • Kurbel, K.: Produktionsplanung und Steuerung • Kurz, A.: Data Warehousing • Lehner, W.: Datenbanktechnologie für Datawarehouse-Systeme 			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Methods for Business Information Systems	3,0	Lecture	german
Literature			
u.a. Ferstl, O., Sinz, E.: Grundlagen der Wirtschaftsinformatik, 6. Auflage, Oldenbourg Verlag (2008)			

Corporate Application Systems	2,0	Lecture	german
Literature			
<ul style="list-style-type: none">• Karl Kurbel, Enterprise Resource Planning und Supply Chain Management in der Industrie, De Gruyter Oldenbourg Verlag, München 2016.• Roland M. Müller, Business Intelligence, Springer, 2013.• Weitere Literatur wird in der Lehrveranstaltung angegeben			

Title	Specialisation - Production and Logistics		
Number	2220060	Module version	V2
Shorttext	WW-AIP-06	Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Automobilwirtschaft und Industrielle Produktion - Lehrstuhl für Produktion und Logistik
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Thomas Spengler
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			
Contents			
<ul style="list-style-type: none"> • Advanced Planning Systems • Forecasting methods • Production programme planning • Materials management • Production control • Process planning • Procurement logistics • distribution logistics • Spare parts logistics • Transport systems and traffic • Reverse logistics 			
Objective qualification			
Students have a basic understanding of production management and logistics issues. With the help of the quantitative and qualitative methods they have learned, they are able to model and solve industrial problems. Students also have a basic understanding of the most important tools such as simulation, optimisation and operational planning systems (APS, ERP).			
Literature			
<ul style="list-style-type: none"> • Günther/Tempelmeier (2009): Produktion und Logistik • Dyckhoff/Spengler (2010): Produktionswirtschaft • Pfohl (2010): Logistiksysteme • Thonemann (2010): Operations Management • eigene Foliensätze/Übungsaufgaben 			



Related courses			
Rules for the choice of courses			
Lecture compulsory. Tutorials and colloquium voluntary.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Operations Management	4,0	Lecture	german
Literature			
<ul style="list-style-type: none"> • Günther/Tempelmeier (2020): Produktion und Logistik • Dyckhoff/Spengler (2010): Produktionswirtschaft • Pfohl (2018): Logistiksysteme • Thonemann (2018): Operations Management • eigene Foliensätze/Übungsaufgaben 			
Bachelor-Colloquium - Production and Logistics	2,0	Colloquium	german
Exercise Operations Management	2,0	Exercise	german
Literature			
<ul style="list-style-type: none"> • Günther/Tempelmeier (2020): Produktion und Logistik • Dyckhoff/Spengler (2010): Produktionswirtschaft • Pfohl (2018): Logistiksysteme • Thonemann (2018): Operations Management • eigene Foliensätze/Übungsaufgaben 			

Title	Specialisation - Marketing		
Number	2221060	Module version	V3
Shorttext	WW-MK-06	Language	german
Frequency of offer	only in the summer term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Marketing und Innovation
Hours per Week / ECTS	0 / 6,0	Module owner	Prof. Dr. Wolfgang Fritz
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			
Contents			
<ul style="list-style-type: none"> • Basic concepts and special features of capital goods marketing; • The marketing management of a capital goods manufacturer; • Business type-specific special problems of capital goods marketing; • Basic concepts and framework conditions of Internet marketing and e-commerce; • The Internet as an instrument of marketing management and e-commerce 			
Objective qualification			
<p>In this module, students acquire the ability to apply and expand their basic marketing knowledge to the special problems of capital goods marketing, internet marketing and market-oriented electronic commerce. After completing the module, they will be able to analyse the marketing situation of a capital goods manufacturer and develop a marketing concept. In addition, students will be able to recognise the special features of marketing in e-commerce and outline a concept for internet marketing.</p>			
Literature			
<ul style="list-style-type: none"> • Backhaus, K. (2003): Industriegütermarketing, 7. Aufl., München 2003. • Backhaus, K./ Voeth, M. (2007): Industriegütermarketing, 8. Aufl., München 2008. • Fritz, W. (2009): Internet-Marketing und Electronic Commerce, 4.Aufl., Wiesbaden 2009. • Folienskripte 			

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Related courses			
Rules for the choice of courses			
Lectures compulsory. Exercises voluntary.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
B2B Marketing	2,0	Lecture	german
Digital Marketing	2,0	Lecture	german

Title	Specialisation - Information Management		
Number	2222140	Module version	V2
Shorttext	WW-WII-14	Language	german
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	
Workload (h)			
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature	<ul style="list-style-type: none"> • Bodendorf, F., Robra-Bissantz, S.: E-Business-Management, Berlin 2009 • Laudon, K. et al.: Wirtschaftsinformatik: Eine Einführung, München 2006 • Kollmann, T.: E-Business: Grundlagen elektronischer Geschäftsprozesse in der Net Economy, Wiesbaden 2008 		

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
	2,0	Colloquium	german
Digital Markets	2,0	Lecture	german
Literature			
Vorlesungsunterlagen zum Download, weitere Literatur wird in der Veranstaltung bekannt gegeben.			

Design Digital Markets	2,0	Project	german
Literature			
Benötigte Literatur wird in der ersten Veranstaltung, je nach Themenbereich, bekannt gegeben.			

Title	Specialisation - Organization and Leadership		
Number	2223040	Module version	V2
Shorttext	WW-ORGF-04	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	
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Recommended requirements	Basic knowledge of management studies, in particular the main functions of planning, decision-making and control.		
Expected performance/ Type of examination	1 written exam (120 min) or 1 take-at-home exam		
Course achievement			
Contents			
<p>Personnel management</p> <ul style="list-style-type: none"> • Tasks and the function of supervisors and • Presentation of the behavioral science principles of personnel management, in particular motivation theory • Basic approaches to personnel management • Practice-dominated management models such as the Harzburg model or "management by" concepts <p>Strategic corporate management</p> <ul style="list-style-type: none"> • Selected approaches to strategic analysis (e.g. experience curve concept, portfolio models and life cycle concepts) • Basic strategies of corporate management • The concept of hypercompetition 			
Objective qualification			
<p>After completing this module, students will be able to understand methods of strategic analysis and the basic strategies of sales-oriented corporate management. Furthermore, students will be introduced to the broad spectrum of possible management styles and models, including their behavioral theory background. After successfully completing the module, students will be able to recognize which leadership behavior is promising in which context.</p>			
Literature			
<p>Human resources management:</p> <ul style="list-style-type: none"> • Oelsnitz, D. von der (2011): Einführung in die systemische Personalführung, Heidelberg. • Neuberger, O. (2002): Führen und führen lassen, 6. Auflage, Stuttgart. • Wunderer, R. (2003): Führung und Zusammenarbeit, 5. Auflage, München/Neuwied. <p>Strategic corporate management:</p> <ul style="list-style-type: none"> • Hungenberg, H. (2008): Strategisches Management in Unternehmen, 5. Auflage, Wiesbaden. 			

2. Welge, M. K. / Al-Laham, A. (2008): Strategisches Management, 5. Auflage, Wiesbaden.
 3. Simon, H. (1988): Management strategischer Wettbewerbsvorteile, in: Zeitschrift für Betriebswirtschaft, 58. Jg., Nr.4, S. 461-480.



Related courses			
Rules for the choice of courses			
Colloquia voluntary			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Leadership	2,0	Lecture	german
Literature			
<ul style="list-style-type: none"> • Oelsnitz, D. von der (2011): Einführung in die systemische Personalführung, Heidelberg. • Neuberger, O. (2002): Führen und führen lassen, 6. Auflage, Stuttgart. • Wunderer, R. (2003): Führung und Zusammenarbeit, 5. Auflage, München/Neuwied. 			
Strategic Management	2,0	Lecture	german
Literature			
<ul style="list-style-type: none"> • Hungenberg, H. (2008): Strategisches Management in Unternehmen, 5. Auflage, Wiesbaden. • Welge, M. K. / Al-Laham, A. (2008): Strategisches Management, 5. Auflage, Wiesbaden. • Simon, H. (1988): Management strategischer Wettbewerbsvorteile, in: Zeitschrift für Betriebswirtschaft, 58. Jg., Nr.4, S. 461-480. 			
	2,0	Colloquium	german
	1,0	Colloquium	german

Title	Specialization - Business Ethics		
Number	2224910	Module version	
Shorttext		Language	german
Frequency of offer		Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	2	Institution	Institut für Unternehmensführung und Organisation
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Ann-Marie Nienaber
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Recommended requirements	Basic knowledge of business administration and an interest in ethical issues in a corporate context are recommended.		
Expected performance/ Type of examination	1 written exam 120 (min) or 1 term paper or 1 presentation or 1 portfolio or 1 oral exam or 1 take-at-home exam		
Course achievement			
Contents			
<p>The module teaches the key principles of business ethics and covers central concepts such as ethics, morality, responsibility and justice. It provides an overview of key ethical theories and their relevance to business activities. It addresses the responsibility of companies towards various stakeholders as well as the opportunities and limitations of corporate social responsibility and sustainability strategies. In addition, current ethical challenges – for example, in the context of digitalisation, global supply chains and technology-driven management – are critically analysed using practical examples and dilemmas.</p>			
Objective qualification			
<p>Upon completion of the module, students will have a sound understanding of key ethical theories and concepts. They will be able to contextualise entrepreneurial activity within society, identify ethical conflicts and reflect on them critically. Particular emphasis is placed on developing reflective skills – a key competence for responsible decision-making in business and society. Students learn to understand responsibility and sustainability not as add-ons, but as integral components of business practice.</p>			
Literature			
<ul style="list-style-type: none"> • Lütge, C., & Uhl, M. (2018). Wirtschaftsethik. Lehrbuch/Studienliteratur. 1. Auflage. München: Vahlen. XII, 268 S. ISBN 978-3-8006-5323-9. • Göbel, E. (2024). Unternehmensethik: Grundlagen und praktische Umsetzung. 7., überarb. Aufl. Stuttgart: UTB. 369 S. ISBN 978-3-8252-8830-3. (Lehrbuch/Studienliteratur, Softcover) • Suchanek, A. (2021). Unternehmensethik: In Vertrauen investieren. 4. Auflage. Tübingen: Mohr Siebeck / UTB. 284 S. ISBN 978-3-8252-5419-3. • Küpper, H.-U. (2020). Einführung in die Wirtschaftsethik. 2. Auflage. München: Schäffer-Poeschel. 316 S. ISBN 978-3-7910-4873-6. 			
<p>Specific references to literature on the respective topics will be presented and made available during the course of the lecture.</p>			



Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Ethics in Business: Fundamentals of responsible Management	2,0	Lecture/Exercise	german
Living Sustainability: Applied Ethics in Business	2,0	Lecture/Exercise	german

Title	Specialisation - Young companies		
Number	2299920	Module version	
Shorttext		Language	german
Frequency of offer	only in the summer term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Automobilwirtschaft und Industrielle Produktion - Lehrstuhl für Produktion und Logistik
Hours per Week / ECTS	5 / 6,0	Module owner	Prof. Dr. Bastian Kindermann
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 term paper or 1 presentation or 1 portfolio or 1 oral exam or 1 take-at-home exam		
Course achievement			
Contents			
<p>The Bachelor's course 'Introduction to Entrepreneurship' guides students through the entire start-up process, from the initial idea to the successful establishment of a start-up. The basic ways of thinking and acting that are particularly relevant for technology-orientated start-up projects are taught. Special emphasis is placed on the development, evaluation and utilisation of technological opportunities. Students learn to develop innovative ideas and evaluate them critically. They are enabled to design viable business models and create a comprehensive business plan. In addition, students acquire the ability to calculate and assess the value and profitability of companies or individual projects.</p>			
Objective qualification			
<p>Students are familiar with the financial, business and legal aspects of setting up a company. They are able to independently assess the economic and technological potential of new companies. They are capable of founding a company.</p>			
Literature			
will be announced at the beginning of the course.			

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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
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Integrating Subjects

Title	Fundamentals of Law		
Number	2216250	Module version	V3
Shorttext	WW-RW-25	Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	2	Institution	
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Anne Paschke
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
<ul style="list-style-type: none"> • Haug, Öffentliches Recht im Überblick, 3. Auflage 2021, • Leipold, BGB I Einführung und Allgemeiner Teil, 10. Auflage, 2019, Mohr Siebeck Verlag, • Brox/Walker, Allgemeines Schuldrecht, 46. Auflage, 2022, Verlag C.H. Beck 			

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

Basics of German Law 1	2,0	Lecture	german
Literature			
<ul style="list-style-type: none"> •Haug, Öffentliches Recht im Überblick, 3. Auflage 2021, •Leipold, BGB I Einführung und Allgemeiner Teil, 10. Auflage, 2019, Mohr Siebeck Verlag, •Brox/Walker, Allgemeines Schuldrecht, 46. Auflage, 2022, Verlag C.H. Beck <p>Weitere Literaturhinweise werden in der Veranstaltung gegeben</p>			
Basics of German Law 2	2,0	Lecture	
Literature			
<ul style="list-style-type: none"> •Haug, Öffentliches Recht im Überblick, 3. Auflage 2021, •Leipold, BGB I Einführung und Allgemeiner Teil, 10. Auflage, 2019, Mohr Siebeck Verlag, •Brox/Walker, Allgemeines Schuldrecht, 46. Auflage, 2022, Verlag C.H. Beck <p>Weitere Literaturhinweise werden in der Veranstaltung gegeben</p>			
	2,0	Exercise	german

Title	Quantitative Methods in Economic Sciences		
Number	2299370	Module version	V2
Shorttext	WW-STD-37	Language	
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	
Hours per Week / ECTS	6 / 8,0	Module owner	Studiendekan der Wirtschaftswissenschaften
Workload (h)	240		
Class attendance (h)	84	Self studying (h)	156
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
<ul style="list-style-type: none"> • Domschke, W.; Drexl, A.: Einführung in Operations Research. 7. Auflage. Springer, 2007. • Domschke, W. et al.: Übungen und Fallbeispiele zum Operations Research. 5. Auflage. Springer, 2004. • Fahrmeir, L. et al.: Statistik: Der Weg zur Datenanalyse. Springer, 2007. • Mosler, K.; Schmid, F.: Beschreibende Statistik und Wirtschaftsstatistik. Springer, 2006. 			

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Operations Research	2,0	Lecture/Exercise	german
Literature			
W. Domschke, A. Drexl: Einführung in Operations Research, Springer, 7. Auflage			
	2,0	Lecture	german

	1,0	Exercise, small group	german
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Title	Computer Science for Engineer		
Number	2416690	Module version	
Shorttext	ET-IDA-69	Language	german
Frequency of offer	only in the summer term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	5 / 6,0	Module owner	Prof. Dr. Andres Gomez
Workload (h)	180		
Class attendance (h)	70	Self studying (h)	110
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			
Contents			
Objective qualification			
Literature			
Mano, Kime, Logic and Computer Design Fundamentals, 4. Ausgabe, Pearson Flik, Mikroprozessortechnik, Springer Herold, Lurz, Wohlrab, Grundlagen der Informatik, Pearson			

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

Title	Programming 1		
Number	4210430	Module version	V2
Shorttext	INF-PRS-43	Language	german
Frequency of offer	only in the winter term	Teaching unit	Carl-Friedrich-Gauß-Fakultät
Module duration	1	Institution	Institut für Betriebssysteme und Rechnerverbund
Hours per Week / ECTS	4 / 6,0	Module owner	Prof. Dr. Martin Johns
Workload (h)	180		
Class attendance (h)	56	Self studying (h)	124
Compulsory requirements			
Expected performance/ Type of examination	1 graded work: Written exam (120 minutes) or Take-Home-Exam.		
Course achievement	1 Coursework: Successful completion of homework assignments		
Contents			
<ul style="list-style-type: none"> - Fundamentals of imperative and object-oriented programming using the Java language - Recursive methods - Reliability of programmes 			
Objective qualification			
After completing this module, students will have a basic understanding of imperative and object-oriented programming as well as the Java language. They will be able to develop small programmes independently.			
Literature			
R. Sedgewick, K. Wayne: Einführung in die Programmierung mit Java. 1. Auflage. Pearson-Verlag, München 2011.			
D. Ratz, J.Scheffler: Grundkurs Programmieren in Java. 6. aktualisierte und erweiterte Auflage. Hanser Verlag, München, Wien 2011.			
R. Schiedermeier: Programmieren mit Java. 2. aktualisierte Auflage. Pearson Studium, München 2010.			
W. Struckmann, D. Wätjen: Mathematik für Informatiker. Spektrum Akademischer Verlag, 2007.			

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Related courses			
Rules for the choice of courses			
The lecture and the small exercise are compulsory. The exercise is optional.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language
Programming 1	2,0	Lecture	german
Literature			
R. Sedgewick, K. Wayne: Einführung in die Programmierung mit Java. 1. Auflage. Pearson-Verlag, München 2011. D. Ratz, J.Scheffler: Grundkurs Programmieren in Java. 6. aktualisierte und erweiterte Auflage. Hanser Verlag, München, Wien 2011. R. Schiedermeier: Programmieren mit Java. 2. aktualisierte Auflage. Pearson Studium, München 2010. W. Struckmann, D. Wätjen: Mathematik für Informatiker. Spektrum Akademischer Verlag, 2007.			
	2,0	Exercise	german
Programming 1	2,0	Exercise, small group	german
Literature			
R. Sedgewick, K. Wayne: Einführung in die Programmierung mit Java. 1. Auflage. Pearson-Verlag, München 2011. D. Ratz, J.Scheffler: Grundkurs Programmieren in Java. 6. aktualisierte und erweiterte Auflage. Hanser Verlag, München, Wien 2011. R. Schiedermeier: Programmieren mit Java. 2. aktualisierte Auflage. Pearson Studium, München 2010. W. Struckmann, D. Wätjen: Mathematik für Informatiker. Spektrum Akademischer Verlag, 2007.			

Interdisciplinary Qualification
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Title	Professionalisation		
Number	2499570	Module version	
Shorttext	ET-STDE-57	Language	german
Frequency of offer	every term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	2	Institution	
Hours per Week / ECTS	0 / 4,0	Module owner	
Workload (h)	180		
Class attendance (h)		Self studying (h)	
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement	according to the requirements of the course taken from the pool		
Contents			
individual			
Objective qualification			
<p>Key skills are acquired in the areas listed below:</p> <p>- Action-orientated courses, scientific cultures</p> <p>Courses from the overall programme (pool) of interdisciplinary courses at the Technische Universität Braunschweig must be selected for this purpose. The type of examination or coursework and the number of credit points will be announced individually for each module.</p> <p>https://www.tu-braunschweig.de/studium-lehre/im-studium/lehrveranstaltungen</p> <p>The Dean of Studies ensures that a list of available courses is published each semester, in which recommendations are made for courses with particular practical relevance.</p>			
Literature			

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Related courses			
Rules for the choice of courses			
A total of 4-6 credits must be earned.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language

Title	Industrial Internship		
Number	2499600	Module version	
Shorttext	ET-STDE-60	Language	german
Frequency of offer	every term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	6 / 6,0	Module owner	
Workload (h)	240		
Class attendance (h)		Self studying (h)	
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement	Written activity report in accordance with the separate regulations "Internship Guidelines of the FK Electrical Engineering, Information Technology, Physics"; Presentation according to § 4 para. 14		
Contents			
Individual; requirements according to internship guidelines			
Objective qualification			
On completion of the module, students will have gained an insight into organisational and operational processes and structures as well as working methods of engineering activities in industrial companies. After completing the module, students will have gained initial concrete experience and the related confidence to act in a professional environment. They will have appropriate patterns and options for action that are appropriate to the situation. These have been developed by dealing with issues such as conducting conversations, presentation techniques, time and self-management, intercultural training and, in particular, through practical experience. Students have become familiar with operational and/or project-related/industry-related processes, in particular working in teams, project work and project organisation.			
Literature			
Remark			
The activities carried out as part of the industrial internship must be presented in an ungraded presentation. This presentation, including preparation and follow-up work, counts for 2 credits within the 8 credits of this module. The workload is exclusively at the location of the industrial partner, usually outside the university.			

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Related courses			
Rules for the choice of courses			
An industrial internship of 6-8 weeks (6-8 CP) can be accredited.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language

Title	Team Project		
Number	2499610	Module version	
Shorttext	ET-STDE-61	Language	german
Frequency of offer	every term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	0 / 8,0	Module owner	
Workload (h)	240		
Class attendance (h)	160	Self studying (h)	80
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement	Draft (§ 9 para. 6 APO) with written project planning and report; Presentation (§ 4 para. 14 BPO)		
Contents			
individual			
Objective qualification			
The team project is generally completed in groups of at least 3 students who carry out the design, analysis, construction or simulation of an electrical or information technology system using an overarching topic as an example.			
Literature			

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Related courses			
Rules for the choice of courses			
The team project can replace the industrial internship.			
Compulsory attendance			
Name of the course	SWS	Eventtype	Language

Title	Bachelor's Thesis		
Number	2499590	Module version	
Shorttext	ET-STDE-59	Language	german
Frequency of offer	every term	Teaching unit	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	Institution	
Hours per Week / ECTS	0 / 15,0	Module owner	Studiendekan Elektrotechnik
Workload (h)	900		
Class attendance (h)		Self studying (h)	
Compulsory requirements			
Expected performance/ Type of examination	Preparation of the Bachelor's thesis; Presentation (according to § 4 para. 14 BPO)		
Course achievement			
Contents			
individual			
Objective qualification			
<p>With the successful completion of the final thesis (§ 14 APO) and the presentation, the student demonstrates that he/she is able to work independently on a problem from the chosen subject area using scientific methods within a specified period of time. The qualification objectives of the degree program (Annex 1, § 2 APO) are reflected in the implementation and results of the final thesis with regard to the following components:</p> <ul style="list-style-type: none"> • Independent familiarisation with and scientific methodical processing of a topic fundamentally relevant to further development and research in the field of electrical engineering • Literature research and presentation of the state of the art • Development of new solution approaches for a scientific problem • Presentation of the approach and results in the form of a paper • Presentation of the main results in a comprehensible form • Consolidation and refinement of key qualifications: management of an own project, presentation techniques and rhetorical skills 			
Literature			
Remark			
The Bachelor's thesis is credited with 12 credits and the presentation with 3 credits.			

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

