Description of the degree program

Technology-oriented Management (Master)
PO 4

Date: 01.10.2025

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Orientation Management Control	**30 ECTS**

Title	Orientation Law		
Number	2216350	**Module version**	V3
Shorttext	WW-RW-35	**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Rechtswissenschaften
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Anne Paschke
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Recommended requirements	Basic knowledge from the module Fundamentals of Law is assumed.		
Expected performance/ Type of examination	1 exam (120 min) or 1 take-at-home exam		
Course achievement	for Organisation, Governance, Education / MA Social Sciences instead of the examination: 1 exam (120 min) or 1 take-at-home exam		

Contents

The content depends on the choice of specialisation:
In the Public Law specialisation, the basic principles of technology law and environmental law are taught. After an introduction to the historical and European and international law principles of the named areas of law, the various forms of these areas of law are examined in more detail with reference to other areas such as the natural sciences and economics. In each case, reference is made to knowledge already acquired by the students.
In the environmental law lecture, construction and immission control law, recycling management law, nature conservation law and climate protection law are examined in detail. The technical law lecture also addresses plant law, product liability law, mobility law, product and equipment safety law, patent law, technical criminal law, data protection law and the creation of technical standards.

In the civil law specialisation, students learn about IT and data law as well as the areas of law that are important for start-ups. The internet has fundamentally changed the way we communicate, analyse, work and consume information, which is why the IT and data law lecture deals with the legal requirements of the digital transformation. Students learn the legal basis for data utilisation and compliance with data protection law. They learn the basics of copyright law and learn what needs to be considered legally when creating a web presence (homepage, web shop, social media account). They are also sensitised to the risks of warnings when selling online. Finally, the lecture takes a closer look at the main features of IT security law.

The Law for Start-Ups course teaches the practical knowledge required to successfully launch a start-up company. Among other things, students learn about different types of companies. They also learn step by step what is required to found a company and what legal issues they will face when the company goes into business, e.g. in the areas of trademark and patent law, commercial and unfair competition law and labour law. In the lecture, the other economics lectures, e.g. on business models, are discussed in order to work on legal challenges.

Objective qualification

The courses teach the following theoretical legal content in order to enable graduates to independently identify the relevant legal standards in their respective specialist area and to make subject-related legal decisions taking into account the current legal situation and to present these in a scientific and practice-oriented manner in writing and orally. Only the application-orientated integrative consideration of legal requirements and technical processes enables legally compliant company/product/production design (compliance).

After completing the module in the Public Law specialisation, students will be able to independently deal with the specialist laws in environmental and technical law and identify relevant legal norms and technical standards. Here, technical examples from other lectures or from the students' internships are taken up and jointly assessed on the basis of the existing legal situation. This enables students to identify the responsible supervisory authorities and independently check whether their plant or machine requires official authorisation or whether it is subject to notification. In this context, the ‘state of the art’ as an important legal concept is also brought to life with examples from technical practice in order to sensitise students to the need to take future developments into account. Students also learn about legal issues relating to the mitigation of the consequences of climate change in order to be able to better assess and implement their significance and consequences from an economic perspective. They also learn about liability responsibilities and can identify liability and sanctioning risks in production processes.

After completing the module in the Civil Law specialisation, students will be able to independently find the specialist laws and relevant standards relevant to them and solve legal issues in IT and data law as well as in the context of company formation and management by working with the law. As regulation in this area is very fast-moving, the teaching of legal methodological skills in particular is of decisive importance in addition to the teaching of specialist skills in order to enable students to apply the law independently. After completing the module, students are sensitised to the content of the lectures in order to behave in a legally compliant manner when using the internet independently (commercially) or when founding a company. They will also have learnt how to ask the right questions to lawyers who support them in enforcing the law.

Literature

For the Public Law specialisation

- Law book
- Umweltrecht dtv. Beck, 31. Aufl. 2022
- Bundes-Immissionsschutzgesetz, dtv. Beck, 17. Aufl. 2022

For the civil law specialisation

- Textbooks

- Ensthaler, Jürgen, Technikrecht: Rechtliche Grundlagen des Technologiemanagments, 2. Aufl. 2022
- Schlacke, Umweltrecht, 8. Aufl. 2021
- Rodi, Handbuch Klimaschutzrecht, 2022

- Law book
- Datenschutzrecht, dtv Beck, 14. Aufl. 2022
- IT- und Computerrecht, dtv. Beck, 15. Aufl. 2022
- Arbeitsgesetze, dtv. Beck, 100. Aufl. 2022

- Textbooks

- Informations- und Kommunikationsrecht, 2018
- Kühling/Klar/Sackmann, Datenschutzrecht, 2021
- Schädel, Wirtschaftsrecht für Hightech-Start-ups, 2019

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Related courses			
Rules for the choice of courses			
One of the two specialisations must be chosen: Public Law: Environmental Law Technology law Civil law: IT and data law Law for StartUps Students on the Master's in Environmental Engineering can only take the Public Law specialisation.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Environmental Law	2,0	Lecture	german
Technology Law	2,0	Lecture	german
Literature			
Wird in der Veranstaltung bekanntgegeben.			
IT- and Data Law	2,0	Lecture	german
Literature			
Wird in der Vorlesung bekannt gegeben.			
Law for StartUps	2,0	Lecture	
Mobility Law	4,0	Lecture	english

Title	Orientation Economics		
Number	2212150	**Module version**	V2
Shorttext	WW-VWL-15	**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Volkswirtschaftslehre
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Felix Rösel
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (90 min) or 1 term paper or 1 oral exam (30 min) or 1 take-at-home exam		
Course achievement	for Organisation, Governance, Education / MA Social Sciences instead of the examination: 1 exam (90 min) or 1 term paper or 1 oral exam (30 min) or 1 take-at-home exam		

Contents

Selected topics from urban and regional economics:

Location theories
Spatial structure and sector theories
Regional economic growth theories

Selected topics from cost-benefit analysis:

Fundamentals of welfare theory
Theory of cost-benefit analysis (and other ex ante analysis methods)
Application of cost-benefit analysis in transport, health, environment and other subject areas

Objective qualification

Students have in-depth knowledge of the structure, functioning and efficiency of different market forms and can determine government measures to improve market outcomes. They are able to apply previously learnt economic thinking to the political system. Students specialise in one area of economics and become familiar with the latest research findings.

Literature

Urban and regional economics:

Farhauer, Oliver, Kröll, Alexandra: Location theories: Regional and urban economics in theory and practice, Springer, current edition.
Maier, Gunther, Tödtling, Franz: Stadt- und Regionalökonomik 1: Standorttheorie und Raumstruktur, Springer, current edition.

Cost-benefit analysis:

Boardman, Anthony, Greenberg, David, Vining, Aidan, Weimer, David: Cost-Benefit Analysis: Concepts and Practice, Pearson New International Edition, current edition.
Hanusch, Horst: Benefit-Cost Analysis, Vahlen, current edition.

Pindyck, Robert S., Rubinfeld, Daniel L.: Mikroökonomie, Pearson Studium, current edition.

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Related courses			
Rules for the choice of courses			
1 event of your choice			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Urban and Regional Economics	4,0	Lecture/Exercise	german
Literature			
• Farhauer, Oliver, Kröll, Alexandra: Standorttheorien: Regional- und Stadtökonomik in Theorie und Praxis, Springer, aktuelle Auflage • Maier, Gunther, Tödtling, Franz: Stadt- und Regionalökonomik 1: Standorttheorie und Raumstruktur, Springer, aktuelle Auflage.			
Cost-Benefit Analysis	4,0	Lecture/Exercise	german
Literature			
• Boardman, Anthony, Greenberg, David, Vining, Aidan, Weimer, David: Cost-Benefit Analysis: Concepts and Practice, Pearson New International Edition, aktuelle Auflage • Hanusch, Horst: Nutzen-Kosten-Analyse, Vahlen, aktuelle Auflage • Pindyck, Robert S., Rubinfeld, Daniel L.: Mikroökonomie, Pearson Studium, aktuelle Auflage			

Title	Orientation Management Control		
Number	2214170	**Module version**	V2
Shorttext	WW-ACuU-17	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Controlling und Unternehmensrechnung
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Heinz Ahn
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Recommended requirements	Basic knowledge of economics is a prerequisite for the module.		
Expected performance/ Type of examination	1 Klausur (90 min) oder 1 Take-at-Home-Exam		
Course achievement	for Organization, Governance, Education / MA Social Sciences instead of the examination performance: 1 written exam, 90 minutes or take-at-home exam		

Contents

Selected contents - depending on the respective current course:
- Effectiveness and efficiency measurement
- Performance indicators
- Budgeting systems
- Transfer pricing systems

Objective qualification

The students understand fundamental topics and methods of management control. Based on this, they are able to analyze related problems, critically evaluate proposed concepts, and soundly support respective decision-making in practice.

Literature

- Weber/Schäffer: Einführung in das Controlling, Stuttgart, aktuelle Auflage
- Ewert/Wagenhofer: Interne Unternehmensrechnung, Berlin et al., aktuelle Auflage
- Eisenführ/Weber/Langer: Rationales Entscheiden, Berlin et al., aktuelle Auflage

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Related courses			
Rules for the choice of courses			
In this module, the courses Coordination Instruments of Controlling (V2, Ü1) and Performance Measurement (V1) are compulsory. Optional colloquia and tutorials are voluntary.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Coordination Instruments for Management Control	3,0	Lecture/Exercise	german
Literature			
Ewert, R./Wagenhofer, (2014): Interne Unternehmensrechnung, 8. Aufl., Berlin et al.			
Performance Analytics	1,0	Lecture	english

Title	Orientation Data-Driven Enterprise		
Number	2218300	**Module version**	
Shorttext	WW-WINFO-30	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Wirtschafts-informatik/Abt. Data-Driven Enterprise
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Frederik Möller
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 term paper & 1 presentation or 1 portfolio or 1 written exam (120 min) or 1 oral exam (30 minutes) or 1 term paper or 1 presentation or 1 take-at-home exam		
Course achievement			

Contents

In “Digital Business Engineering”, students acquire in-depth knowledge about the transformation of business models through a series of practical case studies and the strategic use of digital technologies and data. Business Engineering provides the theoretical framework. It offers a methodology for designing business models and is a model-driven and design-oriented approach to transforming companies. In the practical part of the course, students learn to apply various business engineering techniques (e.g. customer process modeling, information architecture design, SWOT analysis and more). The aim of the practical part is the independent (but guided) solving of a practical problem using the methods and techniques taught by the chair.

Objective qualification

After completing the module, students are able to apply business engineering techniques. Students will also be able to explain business engineering concepts and apply them to unfamiliar problems.

Literature

- OSTERWALDER, Alexander; PIGNEUR, Yves. Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons, 2010.
- OSTERWALDER, Alexander; PIGNEUR, Yves; TUCCI, Christopher L. Clarifying business models: Origins, present, and future of the concept. Communications of the association for Information Systems, 2005, 16. Jg., Nr. 1,
- MÖLLER, Frederik, et al. Designing business model taxonomies–synthesis and guidance from information systems research. Electronic Markets, 2022, S. 1-26.

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

Literature

- OSTERWALDER, Alexander; PIGNEUR, Yves. *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons, 2010.
- OSTERWALDER, Alexander; PIGNEUR, Yves; TUCCI, Christopher L. Clarifying business models: Origins, present, and future of the concept. *Communications of the association for Information Systems*, 2005, 16. Jg., Nr. 1,
- MÖLLER, Frederik, et al. Designing business model taxonomies–synthesis and guidance from information systems research. *Electronic Markets*, 2022, S. 1-26.

Digital Business Models and Sustainability	4,0	Lecture/Exercise	german

Literature

- Hahn, R. (2022). Sustainability management: Global perspectives on concepts, instruments, and stakeholders.
- Lüdeke-Freund, F., Carroux, S., Joyce, A., Massa, L., & Breuer, H. (2018). The sustainable business model pattern taxonomy—45 patterns to support sustainability-oriented business model innovation. Sustainable Production and Consumption, 15, 145-162.
- Osterwalder, A., & Pigneur, Y. (2010). Business model generation: a handbook for visionaries, game changers, and challengers (Vol. 1). John Wiley & Sons.
- Schaltegger, S., Lüdeke-Freund, F., & Hansen, E. G. (2016). Business models for sustainability: A co-evolutionary analysis of sustainable entrepreneurship, innovation, and transformation. Organization & environment, 29(3), 264-289.
- Schoormann, T., Stadtländer, M., & Knackstedt, R. (2021). Designing business model development tools for sustainability—a design science study. Electronic Markets, 1-23.

Title	Orientation Decision Support		
Number	2218220	**Module version**	V2
Shorttext	WW-WINFO-22	**Language**	english german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Wirtschaftsinformatik - Lehrstuhl für Decision Support
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Dirk Mattfeld
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (120 min) or 1 take-at-home exam		
Course achievement	only for Organisation, Governance, Education instead of the exam: 1 exam (120 min) or 1 take-at-home exam		

Contents

Selected contents - depending on the course selection:

Importance of information modelling for planning problems
Classification methods
Cluster analysis
Association analysis
Network models for route planning
Exciting trees, shortest paths
Round trip and route planning problems
Exact and heuristic methods for route planning

Objective qualification

Students have an insight into models and methods of data analysis and decision support. Students are able to map processes from the areas of mobility and transport in information and decision support models. They are familiar with algorithmic methods for analysing systems and generating recommendations for action.

Literature

- Vahrenkamp, R.; Mattfeld, D.C.: Logistiknetzwerke: Modelle für Standortwahl und Tourenplanung. Gabler, 2007.
- Berthold, M. et al: Guide to Intelligent Data Analysis
- Gabriel, R. et al: Computergestützte Informations- und Kommunikationssysteme in der Unternehmung. Technologien, Anwendungen, Gestaltungskonzepte. 2. Auflage. Springer, 2001.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Intelligent Data Analysis	2,0	Lecture	german
Literature			
M.R. Berthold, C. Borgelt, F. Höppner, F. Klawonn: Guide to Intelligent Data Analysis: How to Intelligently Make Sense of Real Data. Springer, London (2010)			
Planning for Mobility and Transportation Purposes	2,0	Lecture	german
Literature			
Dirk C. Mattfeld, Richard Vahrenkamp: Logistiknetzwerke - Modelle für Standortwahl und Tourenplanung, Springer, 2. Aufl. 2014			

Title	Orientation Finance		
Number	2215000040	**Module version**	
Shorttext	WW-FIWI-08	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Finanzwirtschaft
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Marc Gürtler
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 written exam (120 min) or 1 oral exam (30 min) or 1 term paper or 1 presentation or 1 portfolio or 1 take-at-home exam		
Course achievement	for Organization, Governance, Education instead of the examination performance: 1 written exam (120 min) or 1 oral exam (30 min) or 1 term paper or 1 presentation or 1 portfolio or 1 take-at-home exam		

Contents

- Management of interest rate risk
- Management of stock price risk (portfolio management)
- Management of foreign exchange risk
- Management of credit risks in banks
- Valuation of financial instruments subject to risk

Objective qualification

Students have knowledge of the measurement, evaluation and management of financial risks and can apply this knowledge to issues faced by banks and insurance companies on the one hand and industrial companies on the other. In particular, students gain in-depth insights into the topics of “credit risks”, “interest rate risks”, “foreign exchange risks” and “stock price risks”.

Literature

- Gürtler (2013): Finanzwirtschaftliches Risikomanagement
- Breuer (2000): Unternehmerisches Währungsmanagement
- Breuer/Gürtler/Schuhmacher (2010): Portfoliomanagement I
- Breuer/Gürtler (2003): Internationales Management
- Hartmann-Wendels/Pfingsten/Weber (2007): Bankbetriebslehre

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Financial Risk Management	4,0	Lecture/Exercise	german
Literature			
vergleiche Homepage des Lehrstuhls			
Risk Management and Sustainability	4,0	Lecture/Exercise	german
Literature			
vergleiche Homepage des Lehrstuhls			

Title	Orientation Marketing		
Number	2221110	**Module version**	V2
Shorttext	WW-MK-11	**Language**	english 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 / 5,0	**Module owner**	Prof. Dr. Wolfgang Fritz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (120 min) or 1 take-home exam		
Course achievement	for Organisation, Governance, Education / MA Social Sciences instead of the examination: 1 exam (120 min) or 1 take-home exam		

Contents

Selected content - depending on the event selection:

Special features of international marketing
Consumer behaviour and organisational buying behaviour
Techniques of data collection and data analysis in marketing

Objective qualification

The aim of the orientation module Marketing is to give students the opportunity to expand their knowledge in a subject that is not one of their specialisations. After completing the module, students will have a sound knowledge of the following areas: 1. buyer behaviour and marketing research, 2. international marketing

Literature

- Zentes, J./Swoboda, B./Schramm-Klein, H. (2006): Internationales Marketing, München 2006
- Kroeber-Riel, W./Weinberg, P./Gröppel-Klein, A. (2008): Konsumentenverhalten, 9. Aufl., München 2008
- Fantapié Altobelli, C. (2007): Marktforschung, Stuttgart 2007
- Folienskripte

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

Sustainability Transformation Management	2,0	Lecture	english
Consumer Behaviour	2,0	Lecture	german

Title	Orientation Marketing		
Number	2221110	**Module version**	V2
Shorttext	WW-MK-11	**Language**	english 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 / 5,0	**Module owner**	Prof. Dr. Christof Backhaus
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (120 min) or 1 take-home exam		
Course achievement	for Organisation, Governance, Education / MA Social Sciences instead of the examination: 1 exam (120 min) or 1 take-home exam		

Contents

Selected content - depending on the event selection:

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Consumer behaviour and organisational buying behaviour
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Literature

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- Kroeber-Riel, W./Weinberg, P./Gröppel-Klein, A. (2008): Konsumentenverhalten, 9. Aufl., München 2008
- Fantapié Altobelli, C. (2007): Marktforschung, Stuttgart 2007
- Folienskripte

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

Consumer Behaviour	2,0	Lecture	german

Sales Management	2,0	Lecture	german
Literature			
• Johnston, Mark W. und Marshall, Greg W. (2021). Sales Force Management – Leadership, Innovation, Technology, 13. ed., New York: Routledge. • sowie zu den einzelnen Kapiteln weitere, in den Veranstaltungsunterlagen aufgeführte Literatur.			

Sales Management	2,0	Exercise	german
Literature			
• Johnston, Mark W. und Marshall, Greg W. (2021). Sales Force Management – Leadership, Innovation, Technology, 13. ed., New York: Routledge. • sowie zu den einzelnen Kapiteln weitere, in den Veranstaltungsunterlagen aufgeführte Literatur.			

Title	Orientation Production and Logistics		
Number	2220250	**Module version**	V2
Shorttext	WW-AIP-25	**Language**	english german
Frequency of offer	every 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 / 5,0	**Module owner**	Prof. Dr. Thomas Spengler
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 written exam 120 (min) or 1 take-at-home exam		
Course achievement	for Organization, Governance, Education / MA Social Sciences instead of the examination performance: 1 written exam 120 (min) or 1 take-at-home exam		

Contents

Selected content - depending on course selection:

Production Facility Management:
The course “Production Facility Management” deals with various issues that arise in the context of production facility planning and operation. First of all, an overview is given of the tasks involved in the project management of a production facility construction project. Of particular relevance here is the interdisciplinary handling of such projects. A special focus is placed on investment and cost planning. Methods are taught with which economically relevant parameters can be estimated based on the technical planning in various project phases. Students are also taught methods for static and dynamic capacity planning. Finally, students are given an overview of configuration planning and maintenance.

Sustainability in Production and Logistics:
The course “Sustainability in Production and Logistics” teaches the main conditions and options to design a sustainable production and logistics system. The initial focus is laid on approaches for the static and dynamic modeling of energy and material flows as well as the design of disassembly and recycling processes. Within the subsequent sustainability assessment, approaches for an economic, environmental, and social assessment of products and processes are presented. This is followed by an introduction to multi-criteria decision-making, which enables the consideration of various sustainability aspects in the context of corporate decisions. The lecture is accompanied by interactive discussions and practical examples from various sectors, such as the steel industry or electromobility.

Operations Management in the Automotive Industry:
In the course "Operations Management in the Automotive Industry," students gain a detailed insight into the methods and concepts for planning and controlling automotive production. Students are introduced to model-based planning approaches, enabling them to solve strategic (network planning), tactical (assembly line balancing), and operational (assembly line sequencing) problems within automotive production. Special focus is the development of mathematical planning models from Operations Management.

Supply Chain Management:
In the course “Supply Chain Management”, a model-based analysis of industrial supply chains is carried out. Special features of various industries such as the automotive, steel, and semiconductor industries are worked out and their effects on the supply chain are illustrated using the models presented. During the course, typical efficiency losses of industrial supply chains are discussed and approaches to maximize the efficiency of a supply chain are presented. Finally, a quantitative planning approach is presented that can be used to create distribution networks depending on product-specific requirements.

Objective qualification

In the "Production and Logistics" orientation, students are taught various quantitative and qualitative methods from Operations Management for evaluating, designing, planning, and controlling sustainable value creation networks. These methods are applied to practical production and logistics-related issues across various disciplines, such as process engineering, electrical engineering, electromobility, mechanical engineering, or the chemical industry.

Through the course, students are empowered to independently apply and develop quantitative and qualitative methods from Operations Management. Additionally, they are able to appropriately apply and adapt the learned methods in collaboration with different disciplines to address specific challenges.

Literature

Textbooks and further literature will be mentioned in the lectures.

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Related courses

Rules for the choice of courses

Production and Logistics A: Supply Chain Management + Operations Management in the Automotive Industry
Production and Logistics B: Asset Management + Sustainability in Production and Logistics

Students in the Master of Social Sciences can only choose option B.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Sustainability in Production and Logistics	2,0	Lecture	german

Literature

- Baumast, A.; Pape, J. (2008): Betriebliches Umweltmanagement: Nachhaltiges Wirtschaften in Unternehmen, Eugen Ulmer: Stuttgart
- Deutsches Institut für Normung (2006): Umweltmanagement – Ökobilanz – Anforderungen und Anleitungen (ISO 14044:2006). Beuth-Verlag. Berlin. Ausgabedatum: 2006-10
- Erbguth, W.; Schlacke, S. (2010): Umweltrecht, Nomos: Baden-Baden
- Spengler, T. (1998): Industrielles Stoffstrommanagement, Erich Schmidt: Berlin
- Walther, G. (2010): Nachhaltige Wertschöpfungsnetzwerke – Überbetriebliche Planung und Steuerung von Stoffströmen entlang des Produktlebenszyklus, Gabler-Verlag: Wiesbaden.

Operations Management in the Automotive Industry	2,0	Lecture	english

Literature

Examples:
- Meyr, H. (2004): Supply chain planning in the German automotive industry, in: OR Spectrum, Vol. 26, No. 4, pp. 447-470 (online available)
- Brabazon, P. G.; MacCarthy, B. (2004): Virtual-build-to-order as a mass Customization order fulfilment model, in: Concurrent Engineering Research and Applications, Vol. 12, No. 2, pp. 155-165 (online available)
- Boysen et al. (2007): A classification of assembly line balancing problems, in: European Journal of Operational Research, Vol. 183, No. 2, pp. 674-693 (online available)
- Boyer, K.; Leong, G. K. (1996): Manufacturing flexibility at the plant level, in: Omega, Vol. 24, No. 5, pp. 495-510.
- Fleischmann, B. et al. (2006): Strategic Planning of BMWs Global Production Network, in: Interfaces, Vol. 36, No. 3, pp. 194-208

Supply Chain Management	2,0	Lecture	english

Literature

- Chopra, S./Meindl, P. (2016): Supply Chain Management – Strategy, Planning, and Operation. Pearson
- Shapiro, J. (2006): Modeling The Supply Chain, Duxbury/Thomson Learning
- Simchi-Levi, D./Kaminsky, P./Simchi-Levi, E. (2007): Designing and Managing the Supply Chain: Concepts, Strategies, and Case studies, McGraw-Hill/Irwin
- Stadtler, H./Kilger, C. (2007): Supply Chain Management and Advanced Planning, Springer

Production Facility Management	2,0	Lecture	german

Literature

- Bernecker (2013): Planung und Bau verfahrenstechnischer Anlagen: Projektmanagement und Fachplanungsfunktionen, 4. Auflage, Springer-Verlag, Berlin.
- Bronner (2001): Industrielle Planungstechniken: Unternehmens-, Produkt- und Investitionsplanung, Kostenrechnung und Terminplanung, Springer-Verlag, Berlin.
- Geldermann, Jutta (2014): Anlagen- und Energiewirtschaft – Kosten- und Investitionsschätzung sowie Technikbewertung von Industrieanlagen, Verlag Franz Vahlen, München.
- Günther, Hans-Otto; Tempelmeier, Horst (2016): Produktion und Logistik, 12. Auflage, Springer-Verlag, Berlin.
- Thonemann, Ulrich (2015): Operations Management – Konzepte, Methoden und Anwendungen, 3. Auflage, Pearson Studium, München.
- Birolini, Alessandro (2017): Reliability Engineering: Theory and Practice, 8. Auflage, Springer-Verlag, Berlin.
- Peters et al. (2003): Plant Design and Economics for Chemical Engineers, 5th Edition, McGraw-Hill, New York.

Title	Orientation Information Management		
Number	2222310	**Module version**	
Shorttext		**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	2	**Institution**	Institut für Wirtschafts-informatik - Abteilung Service-Informationssy-steme
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Susanne Robra-Bissantz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Recommended requirements	The prerequisite for the module is basic knowledge in economics.		
Expected performance/ Type of examina-tion	1 assignment or 1 exam (120 min) or 1 portfolio or 1 take-at-home-exam or 1 exam+		
Course achievement	for Organisation, Governance, Education / MA Social Sciences instead of the exami-nation: 1 term paper or 1 exam (120 min) or 1 portfolio or 1 take-at-home exam		

Contents

Selected content – depending on the course selection:
- Servicification
- Role of IT in Service Processes
- Service Dominant Logic
- Digital Products
- Value in Interaction
- E-Services
- Service Design
- Service Ecosystems and Platforms
- Digital Economy
- Digital Management
- Cooperation and Collaboration
- Digital Collaboration

Objective qualification

Students understand the strategic relevance of information systems for companies in terms of operational tasks, people and technology. They are familiar with concepts for internal or inter-company IT-supported co-operation as well as their objectives and strategies in the context of strategic management. A possible spe-cialisation is the view of application systems as e-services.

Literature

Course materials are provided on Stud.IP, along with additional literature.

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Related courses			
Rules for the choice of courses			
Colloquium optional			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Digital Transformation: Collaborations	2,0	Lecture	german
Literature			
• Vorlesungsunterlagen zum Download • Weitere Literatur wird in der Veranstaltung bekannt gegeben			
Digital Transformation: Services	2,0	Lecture	german
Literature			
Vorlesungsunterlagen per Download, weitere Literatur wird in der Veranstaltung bekannt gegeben.			
	2,0	Colloquium	german

Title	Orientation Management and Organisation Science		
Number	2223100	**Module version**	V2
Shorttext	WW-ORGF-10	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Unternehmensführung und Organisation
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Dietrich von der Oelsnitz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 written exam (90 minutes) or 1 take-home exam		
Course achievement	For Organization, Governance, Education / MA Social Sciences instead of the exam: 1 written exam (90 minutes) or 1 take-home exam		

Contents

Depending on the chosen courses, practical and theoretical knowledge in the areas of organization and team management, as well as inter-organizational networks, are covered.

Objective qualification

After completing this module, students will have an in-depth understanding of the organization and processes within and between companies. They will learn how to systematically develop and maintain a company's knowledge base. Students will be able to explain the actions and behavior of organizational members and understand organizations as socio-technical systems.

Literature

- Oelsnitz, D. von der (2009): Die innovative Organisation, 2. Aufl., Stuttgart.
- Schulte-Zurhausen, M. (2005): Organisation, 4. Aufl., München.
- Schreyögg, G. (2008): Organisation, 5. Aufl., Wiesbaden.
- Stock-Homburg, R. (2008): Personalmanagement, Wiesbaden.
- Gemünden, H.G./Högl, M. (2005): Teamarbeit in innovativen Projekten, in: Högl, M./Gemünden, H.G. (Hrsg.): Management von Teams, 3. Aufl., Wiesbaden, S. 1-31.

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Related courses

Rules for the choice of courses

Compulsory attendance

Name of the course	SWS	Eventtype	Language

Organization	2,0	Lecture	german
Literature			
• Oelsnitz, D. von der (2009): Die innovative Organisation, 2. Aufl., Stuttgart. • Schulte-Zurhausen, M. (2005): Organisation, 4. Aufl., München • Schreyögg, G. (2008): Organisation, 5. Aufl., Wiesbaden.			

Team Management	1,0	Lecture	german
Literature			
• Stock-Homburg, R. (2008): Personalmanagement, Wiesbaden. • Gemünden, H.G./Högl, M. (2005): Teamarbeit in innovativen Projekten, in: Högl, M./Gemünden, H.G. (Hrsg.): Management von Teams, 3. Aufl., Wiesbaden, S. 1-31. • Oelsnitz, D. von der (2005): Kooperation: Entwicklung und Verknüpfung von Kernkompetenzen, in: Zentes, J./Swoboda, B./Morschett, D. (Hrsg.): Kooperationen, Allianzen und Netzwerke, 2. Aufl., Wiesbaden, S. 183-210.			

Team and Organizational Management	1,0	Exercise	german

		Colloquium	german

Organization and Change	4,0	Lecture/Exercise	english german
Literature			
• Oelsnitz, D. von der (2009): Die innovative Organisation, 2. Aufl., Stuttgart. • Schulte-Zurhausen, M. (2005): Organisation, 4. Aufl., München • Schreyögg, G. (2008): Organisation, 5. Aufl., Wiesbaden.			

Title	Orientation Services Management		
Number	2201000000	**Module version**	
Shorttext		**Language**	english german
Frequency of offer	every 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 / 5,0	**Module owner**	Prof. Dr. David Woisetschläger
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 portfolio or 1 take-home exam		
Course achievement	for Organization, Governance, Education / MA Social Sciences instead of the examination performance: 1 portfolio or 1 take-home exam		

Contents

Contents - depending on the course selection:

Strategic Brand Management & Brand Strategy Bootcamp
Contents of the lecture include
- Brand understanding and the importance of brands
- Measurement of brand associations
- Secondary brand associations
- Instruments for building brand associations
- Brand strategy and positioning
- Brand architecture
- Measuring brand performance
- International brand management
- Internal brand management
- Organizational aspects of brand management
- Sectoral specialties in retail, industrial goods and the luxury sector.

Contents of the exercise are:
Working on a real practical problem in the field of brand management in cooperation with a company partner.

Business Model Innovation & Service Innovation
Contents of the lecture include:
- Relevance, importance and understanding of business model innovations
- Organizational success factors and barriers
- Transformation of existing business models
- Methods of business model innovation
- Building blocks of business model innovation and related methods
- Sectoral aspects such as innovation in mobility

Contents of the exercise are:
Application of service innovation methods on a practical example.

Customer Relationship Management & Customer Analytics
Contents of the lecture include:
- Relevance, importance and understanding of customer relationship management
- Theoretical foundations of CRM
- Target indicators of CRM
- Lifecycle perspective of the customer relationship
- Acquisition and new customer management
- Customer loyalty programs
- Types and management of switching barriers
- Customer evaluation and segmentation
- Expansion of customer relationships
- Complaint management
- Termination prevention and reactivation management
- Customer data and privacy

Contents of the exercise include learning and applying methods
- to calculate customer value
- to evaluate the customer relationship (e.g. satisfaction, loyalty, recommendation)
- to calculate customer churn or the probability of churn
- to evaluate the success of promotions and reactivation measures

Objective qualification

Depending on the selected courses:

After successful participation, students will have a basic understanding of brands and knowledge of which aspects play a role in branding. In addition, they will understand and be able to critically discuss how brands are developed and positioned and which instruments are suitable for this. They can argue on the basis of theory why certain brand-related measures can be expected to have an effect and have methodological knowledge in order to measure the brand and quantify influencing factors. Students will be able to formulate precise problems and research questions based on a complex practical issue in the field of brand management and develop a solution to the problem using the content and methods learned in the lecture.

After successful participation, students have a basic understanding of business model innovation and know which factors play a role in the development of business model innovations. In addition, they will understand and be able to critically discuss how innovations are developed and which methods are suitable for this. They can argue on the basis of theory why certain corporate measures can be expected to have an effect on the success of innovation and have methodological knowledge to develop, evaluate and critically reflect on business model innovations themselves. Students can formulate precise problems and research questions based on a complex practical issue in the field of innovation management and develop solutions to problems using the content and methods learned in the lecture and taught in the exercise.

Students have an understanding of issues that arise in the context of recording, designing and evaluating customer relationships. Based on the concepts and methods they have learned, students will be able to independently record, conceptually structure and analyze customer relationship management issues in various industry contexts. They have methodological and application knowledge for the qualitative and quantitative analysis of customer and company data required to answer customer relationship management tasks.

Literature

Strategic Brand Management & Brand Strategy Bootcamp
- Keller, Kevin L. und V. Swaminathan (2019): Strategic Brand Management - Building, Measuring, and Managing Brand Equity, 5th ed., Prentice Hall
- Supplementary journal paper per chapter
- Lecture notes for download.
- Supplementary information and literature as bibliography and/or download for the exercise.

Business Model Innovation & Service Innovation

- Textbooks and further literature will be announced in the lectures
- Supplementary literature (PDF documents, lecture notes for download)

Customer Relationship Management & Customer Analytics
- Kumar, V. and Werner Reinartz (2018): Customer Relationship Management: Concept, Strategy, and Tools, 3. ed., Springer.
- Textbooks and further literature will be announced in the lectures
- Supplementary literature (PDF documents, lecture notes for download)

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Related courses

Rules for the choice of courses

Students must choose a course from the following program:
- Strategic Brand Management & Brand Strategy Bootcamp
- Business Model Innovation & Service Innovation
- Customer Relationship Management & Customer Analytics

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Business Model Innovation: Concepts and Applications	4,0	Lecture/Exercise	english

Literature

- Lehrbücher und weiterführende Literatur werden in den Veranstaltungen bekannt gegeben
- Ergänzende Literatur (PDF-Dokumente, Vorlesungsunterlagen zum Download)

Strategic Brand Management: Concepts and Applications	4,0	Lecture/Exercise	german

Literature

- Keller, Kevin L. und V. Swaminathan (2019): Strategic Brand Management - Building, Measuring, and Managing Brand Equity, 5th ed., Prentice Hall
- Ergänzende Journalpaper je Kapitel
- Vorlesungsunterlagen zum Download.
- Ergänzende Informationen und Literatur als Literaturverzeichnis und/oder zum Download zur Übung.

Customer Relationship Management and Customer Analytics	4,0	Lecture/Exercise	german

Literature

- Kumar, V. and Werner Reinartz (2018): Customer Relationship Management: Concept, Strategy, and Tools, 3. ed., Springer.
- Lehrbücher und weiterführende Literatur werden in den Veranstaltungen bekannt gegeben
- Ergänzende Literatur (PDF-Dokumente, Vorlesungsunterlagen zum Download

Title	Orientation Business Creation and Succession		
Number	2225000030	**Module version**	
Shorttext		**Language**	english
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Department Wirtschafts-wissenschaften
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Bastian Kinder-mann
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examina-tion	1 Portfolio or 1 written exam (120 min) or 1 oral exam (30 min) or 1 term paper oder 1 presentation oder 1 term paper & 1 presentation oder 1 Take-at-Home-Exam		
Course achievement			

Contents

Principles of Strategy & Entrepreneurship
In our research-oriented master-level course “Principles of Strategy & Entrepreneurship”, we will explore core questions of strategic management and delve into the process of new venture creation.
The course covers seven main areas:
1. Foundations: Tracing the origins of the strategy concept
2. Strategy & economics: Exploring the influence of economics on the notion of strategy
3. Strategy making: Understanding different perspectives on the strategy formation process
4. Competitive strategies: Learning about strategy in competitive settings
5. Cooperative strategies: Examining strategy in cooperative settings
6. Strategic entrepreneurship: Getting familiarized with strategy perspectives on new venture creation
7. Digital strategy: Delving into digital platform strategies.

Strategic Innovation Management
The master-level course “Strategic Innovation Management” offers participants a holistic guideline through the process of innovation management. The course content spans topics such as strategy development, the creation of innovation-focused firm cultures and leadership, and the expansion into global markets. In addition, we will explore concrete innovation strategies related to open innovation and (digital) platforms.

Objective qualification

After completing this module, students will be able to understand the processes of strategy development and innovation management and implement them in established companies and start-ups. Students also learn which criteria to apply when choosing a suitable strategy and how they can drive innovation processes on this basis. These skills not only prepare participants for future research-related work (e.g. Master's theses, doctorates), but also for career opportunities in management consulting, strategy departments, corporate development, innovation departments and start-ups.

Literature

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Related courses			
Rules for the choice of courses			
1 course of your choice			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Principles of Strategy & Entrepreneurship	4,0	Lecture/Exercise	english
Literature			
will be announced at the beginning of the course			
Strategic Innovation Management	4,0	Lecture/Exercise	english
Literature			
will be announced at the beginning of the course			

Specialisation Management	**10 ECTS**

Title	Specialisation Management Controlling		
Number	2214000000	**Module version**	
Shorttext		**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 / 5,0	**Module owner**	Prof. Dr. Heinz Ahn
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam+ (30 min) or 1 take-home exam or 1 oral exam+ (20 min)		
Course achievement	1 presentation or 1 term paper or 1 presentation or 1 portfolio for Organisation, Governance, Education / MA Social Sciences instead of the examination additionally: 1 exam+ (30 min) or 1 take-home exam or 1 oral exam+ (20 min)		

Contents

Selected contents – depending on the respective current course:
- Management control in practice and research
- Controlling of risks and chances
- Project controlling

Effectiveness and efficiency analysis

Objective qualification

The students have a deeper understanding of actual topics and methods of management control. Based on this, they are able to analyze related problems, critically evaluate proposed concepts, and soundly support respective decision-making in practice. Furthermore, they are qualified to pursue academic work with the aim of writing a doctoral thesis.

Literature

- Weber/Schäffer: Einführung in das Controlling, Stuttgart, aktuelle Auflage
- Ewert/Wagenhofer: Interne Unternehmensrechnung, Berlin et al., aktuelle Auflage
- Eisenführ/Weber/Langer: Rationales Entscheiden, Berlin et al., aktuelle Auflage

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Related courses

Rules for the choice of courses

The module consists of two variants, one of which must be taken:

Variant A:
Current Topics in Controlling (VR3) and Advanced Performance Measurement (V1) are compulsory.
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Variant B:
Performance Analysis Projects is compulsory.
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Any colloquia and tutorials offered are voluntary in both variants.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Advanced Performance Analytics	1,0	Lecture	english
Actual Topics of Management Control	3,0	Series of lectures	german

Literature

- Weber, U./Schäffer, J. (2016), Einführung in das Controlling, Stuttgart
- Ahn, H. (2003), Effektivitäts- und Effizienzsicherung - Controlling-Konzept und Balanced Scorecard, Frankfurt/M. et al.
- Ahn, H./Dyckhoff, H. (2004), Zum Kern des Controllings - Von der Rationalitätssicherung zur Effektivitäts- und Effizienzsicherung, in: Scherm/Pietsch (Hrsg.): Controlling - Theorien und Konzeptionen, München, S. 501-525

Actual Topics of Management Control	3,0	Series of lectures	german

Literature

- Weber, U./Schäffer, J. (2016), Einführung in das Controlling, Stuttgart
- Ahn, H. (2003), Effektivitäts- und Effizienzsicherung - Controlling-Konzept und Balanced Scorecard, Frankfurt/M. et al.
- Ahn, H./Dyckhoff, H. (2004), Zum Kern des Controllings - Von der Rationalitätssicherung zur Effektivitäts- und Effizienzsicherung, in: Scherm/Pietsch (Hrsg.): Controlling - Theorien und Konzeptionen, München, S. 501-525

Performance Analysis Projects	4,0	Series of lectures	german

Title	Specialisation Decision Support		
Number	2218250	**Module version**	V2
Shorttext	WW-WINFO-2	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Wirtschaftsinformatik - Lehrstuhl für Decision Support
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Dirk Mattfeld
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (60 min) or 1 take-at-home exam (2.5 CP)		
Course achievement	Exercises (for the exercise(s)) (2.5 CP) only for Organisation, Governance, Education instead of the examination additionally 1 exam (60 min) or 1 take-at-home exam (2.5 CP)		

Contents

Selected content - depending on the course selection:

Business requirements for information systems in logistics and transport (ISLV)
Conception of ISLV
Functionality and examples of ISLV
Importance of information modelling for planning problems
Classification methods
Cluster analysis
Association analysis
Network models for route planning
Exciting trees, shortest paths

Objective qualification

Students have an in-depth understanding of the structure and design of information systems for mobility applications. The module enables students to transfer their basic knowledge of information systems for mobility applications to other domains. Through exercises, students consolidate the use of methods and models.

Literature

- Vahrenkamp, R.; Mattfeld, D.C.: Logistiknetzwerke: Modelle für Standortwahl und Tourenplanung. Gabler, 2007.
- Berthold, M. et al: Guide to Intelligent Data Analysis
- Gabriel, R. et al: Computergestützte Informations- und Kommunikationssysteme in der Unternehmung. Technologien, Anwendungen, Gestaltungskonzepte. 2. Auflage. Springer, 2001.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Data Driven Decision Making	2,0	Lecture	german
Literature			
wird in der Vorlesung bekannt gegeben			
Data Driven Decision Making - Exercise	2,0	Exercise	german

Title	Specialisation Finance		
Number	2215000030	**Module version**	
Shorttext	WW-FIWI-10	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Finanzwirtschaft
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Marc Gürtler
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 written exam (120 min) or 1 term paper or 1 oral exam (30 min) or 1 presentation or 1 portfolio or 1 take-at-home exam		
Course achievement	for Organization, Governance, Education instead of the examination performance: 1 written exam (120 min) or 1 term paper or 1 oral exam (30 min) or 1 presentation or 1 portfolio or 1 take-at-home exam		

Contents

- Advanced methods and techniques of machine and statistical learning (e.g. tree-based methods, neural networks, support vector machines, cluster analysis, explainable artificial intelligence (AI))
- Application of the methods to forecasting and estimation problems in the financial sector
- Implementation of the methods, especially in the context of scientific case studies

Objective qualification

Students have the ability to use advanced methods of machine and statistical learning for forecasting and estimation problems in finance and to implement them in specific case studies using statistical software packages. Furthermore, students know the structured procedure that should be followed for implementation in the context of practical and scientific empirical projects.

Literature

- Gürtler (2013): Finanzwirtschaftliches Risikomanagement
- Wooldridge (2015): Introductory Econometrics – A Modern Approach
- von Auer (2011): Ökonometrie
- Brooks (2008): Econometrics for Finance
- Galeotti/Gürtler/Winkelvos (2013): Accuracy of Premium - Calculation Models for CAT Bonds – an Empirical Analysis
- Gürtler/Hibbeln (2013): Do Investors Consider Asymmetric Information in Pricing Securitizations?
- Gürtler/Hibbeln/Winkelvos (2016): The Impact of the Financial Crisis and Natural Catastrophes on CAT Bonds

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Related courses			
Rules for the choice of courses			
The course Machine Learning and Data Science in Finance is compulsory. The colloquium is voluntary.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Machine Learning and Data Science in Finance	4,0	Lecture/Exercise	german
Literature			
vergleiche Homepage des Lehrstuhls			
	2,0	Colloquium	german

Title	Specialisation Marketing		
Number	2221120	**Module version**	V3
Shorttext	WW-MK-12	**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	4 / 5,0	**Module owner**	Prof. Dr. Wolfgang Fritz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (60 min) or 1 take-at-home exam (2.5 CP)		
Course achievement	1 written exam (60 min) or 1 exercise task or 1 take-at-home exam (for the exercise) (2.5 CP) for Organisation, Governance, Education / MA Social Sciences instead of the examination additionally: 1 exam (60 min) or 1 take-at-home exam (2.5 CP)		

Contents

Selected contents - depending on the course selection:

Selected aspects of distribution management
Techniques of data collection and data analysis in marketing
In-depth study of selected marketing topics using case studies and exercises

Objective qualification

After completing this module, students have a sound knowledge of the areas of distribution management, international marketing, buyer behaviour and marketing research. They are able to think through, structure and solve marketing problems of various kinds.

Literature

- Zentes, J./Swoboda, B./Schramm-Klein, H. (2006): Internationales Marketing, München 2006
- Kroeber-Riel, W./Weinberg, P./Gröppel-Klein, A. (2008): Konsumentenverhalten, 9. Aufl., München 2008
- Fantapié Altobelli, C. (2007): Marktforschung, Stuttgart 2007
- Specht, G./Fritz, W. (2005): Distributionsmanagement, 4. Aufl., Stuttgart 2005
- Folienskripte

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Related courses

Rules for the choice of courses

Sales management and the exercise Sustainability Transformation Management are compulsory.
The exercise Sales Management is voluntary and only for exam preparation.
The order of the courses is arbitrary.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Sales Management	2,0	Lecture	german

Literature

- Johnston, Mark W. und Marshall, Greg W. (2021). Sales Force Management – Leadership, Innovation, Technology, 13. ed., New York: Routledge.
- sowie zu den einzelnen Kapiteln weitere, in den Veranstaltungsunterlagen aufgeführte Literatur.

Exercise - Sustainability Transformation Management	2,0	Exercise	english
Sales Management	2,0	Exercise	german

Literature

- Johnston, Mark W. und Marshall, Greg W. (2021). Sales Force Management – Leadership, Innovation, Technology, 13. ed., New York: Routledge.
- sowie zu den einzelnen Kapiteln weitere, in den Veranstaltungsunterlagen aufgeführte Literatur.

Title	Specialisation Marketing		
Number	2221120	**Module version**	V4
Shorttext	WW-MK-12	**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	4 / 5,0	**Module owner**	Prof. Dr. Wolfgang Fritz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (60 min) or 1 take-at-home exam (2.5 CP)		
Course achievement	1 written exam (60 min) or 1 exercise task or 1 take-at-home exam (for the exercise) (2.5 CP) for Organisation, Governance, Education / MA Social Sciences instead of the examination additionally: 1 exam (60 min) or 1 take-at-home exam (2.5 CP)		

Contents

Selected contents - depending on the course selection:

Selected aspects of distribution management
Techniques of data collection and data analysis in marketing
In-depth study of selected marketing topics using case studies and exercises

Objective qualification

After completing this module, students have a sound knowledge of the areas of distribution management, international marketing, buyer behaviour and marketing research. They are able to think through, structure and solve marketing problems of various kinds.

Literature

- Zentes, J./Swoboda, B./Schramm-Klein, H. (2006): Internationales Marketing, München 2006
- Kroeber-Riel, W./Weinberg, P./Gröppel-Klein, A. (2008): Konsumentenverhalten, 9. Aufl., München 2008
- Fantapié Altobelli, C. (2007): Marktforschung, Stuttgart 2007
- Specht, G./Fritz, W. (2005): Distributionsmanagement, 4. Aufl., Stuttgart 2005
- Folienskripte

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Related courses			
Rules for the choice of courses			
The lecture and exercise Sustainability Transformation Management are compulsory.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Sustainability Transformation Management	2,0	Lecture	english
Exercise - Sustainability Transformation Management	2,0	Exercise	english

Title	Specialisation Production and Logistics		
Number	2220260	**Module version**	V2
Shorttext	WW-AIP-26	**Language**	english german
Frequency of offer	every 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 / 5,0	**Module owner**	Prof. Dr. Thomas Spengler
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam 120 (min) or 1 take-at-home exam (on the 2 lectures of the chosen combination)		
Course achievement	only for Organisation, Governance, Education instead of the exam: 1 exam 120 (min) or 1 take-at-home exam (on the 2 lectures of the chosen combination)		

Contents

Selected content - depending on the course selection:

Plant management:
The course ‘Plant Management’ deals with various issues that arise in the context of plant planning and plant operation. Firstly, an overview is given of the tasks involved in the project management of a plant construction project. Of particular relevance here is the interdisciplinary handling of such projects. A special focus is placed on investment and cost planning. Methods are taught with which economically relevant parameters can be estimated on the basis of technical planning in various project phases. Students are also taught methods for static and dynamic capacity planning. Finally, students are given an overview of plant configuration planning and plant maintenance.

Sustainability in production and logistics:
In the course ‘Sustainability in Production and Logistics’, the relevant framework conditions and possibilities for designing sustainable production and logistics are taught. The focus is initially placed on approaches to static and dynamic modelling of energy and material flows as well as the design of dismantling and recycling. Within the subsequent sustainability assessment, approaches for an economic, ecological and social assessment of a product or process are presented. This is followed by an introduction to multi-criteria decision-making, which enables various aspects of sustainability to be taken into account when making business decisions. The lecture is accompanied by interactive discussions and application examples from various sectors, such as the steel industry or electromobility.

Operations Management in the Automotive Industry:
As part of the course ‘Operations Management in the Automotive Industry’, students gain a detailed insight into the methods and concepts for planning and controlling automotive production. Students learn about model-based planning approaches that enable them to solve strategic (network planning), tactical (assembly line balancing) and operational (assembly line sequencing) problems in the context of automotive production. A particular focus is always on integrating the special technical challenges of the automotive industry into the respective planning approaches.

Supply Chain Management:
In the course ‘Supply Chain Management’, a model-based analysis of industrial supply chains is carried out. Special features of various industries such as the automotive, steel and semiconductor industries are analysed and their effects on the supply chain are illustrated using the models presented. During the course, typical efficiency losses of industrial supply chains are discussed and approaches to maximise the efficiency of a supply chain are presented. Finally, a quantitative planning approach is presented that can be used to create distribution networks depending on product-specific requirements.

Master's Colloquium - Production and Logistics:
In the Master's colloquium, students are given the opportunity to present and discuss their Master's and diploma theses.

Objective qualification

The Production and Logistics specialisation builds on the quantitative and qualitative methods of economics learned in the orientation. The methods learnt are extended and further methods are introduced. Furthermore, additional subject areas are addressed in which the methods are applied.

The course enables students to independently apply and develop quantitative and qualitative methods in economics. In addition, students will be able to apply and adapt the methods they have learnt in cooperation with different subject areas to the specific challenges of the subject.

Literature

Textbooks and further reading will be given in the lectures

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Related courses

Rules for the choice of courses

Depending on the chosen combination in the corresponding orientation, the following combinations are possible:

Production and Logistics A: Supply Chain Management + Operations Management in the Automotive Industry
(Orientation consisted of Production and Logistics B: Plant Management + Sustainability in Production and Logistics)

Production and Logistics B: Plant Management + Sustainability in Production and Logistics
(Orientation consisted of Production and Logistics A: Supply Chain Management + Operations Management in the Automotive Industry)

The colloquium is voluntary.

Compulsory attendance

Name of the course	SWS	Eventtype	Language

Sustainability in Production and Logistics	2,0	Lecture	german

Literature

- Baumast, A.; Pape, J. (2008): Betriebliches Umweltmanagement: Nachhaltiges Wirtschaften in Unternehmen, Eugen Ulmer: Stuttgart
- Deutsches Institut für Normung (2006): Umweltmanagement – Ökobilanz – Anforderungen und Anleitungen (ISO 14044:2006). Beuth-Verlag. Berlin. Ausgabedatum: 2006-10
- Erbguth, W.; Schlacke, S. (2010): Umweltrecht, Nomos: Baden-Baden
- Spengler, T. (1998): Industrielles Stoffstrommanagement, Erich Schmidt: Berlin
- Walther, G. (2010): Nachhaltige Wertschöpfungsnetzwerke – Überbetriebliche Planung und Steuerung von Stoffströmen entlang des Produktlebenszyklus, Gabler-Verlag: Wiesbaden.

	2,0	Colloquium	german

Operations Management in the Automotive Industry	2,0	Lecture	english

Literature

Examples:

- Meyr, H. (2004): Supply chain planning in the German automotive industry, in: OR Spectrum, Vol. 26, No. 4, pp. 447-470 (online available)
- Brabazon, P. G.; MacCarthy, B. (2004): Virtual-build-to-order as a mass Customization order fulfilment model, in: Concurrent Engineering Research and Applications, Vol. 12, No. 2, pp. 155-165 (online available)
- Boysen et al. (2007): A classification of assembly line balancing problems, in: European Journal of Operational Research, Vol. 183, No. 2, pp. 674-693 (online available)
- Boyer, K.; Leong, G. K. (1996): Manufacturing flexibility at the plant level, in: Omega, Vol. 24, No. 5, pp. 495-510.
- Fleischmann, B. et al. (2006): Strategic Planning of BMWs Global Production Network, in: Interfaces, Vol. 36, No. 3, pp. 194-208

Production Facility Management	2,0	Lecture	german

Literature

- Bernecker (2013): Planung und Bau verfahrenstechnischer Anlagen: Projektmanagement und Fachplanungsfunktionen, 4. Auflage, Springer-Verlag, Berlin.
- Bronner (2001): Industrielle Planungstechniken: Unternehmens-, Produkt- und Investitionsplanung, Kostenrechnung und Terminplanung, Springer-Verlag, Berlin.
- Geldermann, Jutta (2014): Anlagen- und Energiewirtschaft – Kosten- und Investitionsschätzung sowie Technikbewertung von Industrieanlagen, Verlag Franz Vahlen, München.
- Günther, Hans-Otto; Tempelmeier, Horst (2016): Produktion und Logistik, 12. Auflage, Springer-Verlag, Berlin.
- Thonemann, Ulrich (2015): Operations Management – Konzepte, Methoden und Anwendungen, 3. Auflage, Pearson Studium, München.
- Birolini, Alessandro (2017): Reliability Engineering: Theory and Practice, 8. Auflage, Springer-Verlag, Berlin.
- Peters et al. (2003): Plant Design and Economics for Chemical Engineers, 5th Edition, McGraw-Hill, New York.

Supply Chain Management	2,0	Lecture	english

Literature

- Chopra, S./Meindl, P. (2016): Supply Chain Management – Strategy, Planning, and Operation. Pearson
- Shapiro, J. (2006): Modeling The Supply Chain, Duxbury/Thomson Learning
- Simchi-Levi, D./Kaminsky, P./Simchi-Levi, E. (2007): Designing and Managing the Supply Chain: Concepts, Strategies, and Case studies, McGraw-Hill/Irwin
- Stadtler, H./Kilger, C. (2007): Supply Chain Management and Advanced Planning, Springer

Title	Specialisation Law		
Number	2216360	**Module version**	V3
Shorttext	WW-RW-36	**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Rechtswis-senschaften
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Anne Paschke
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examina-tion	1 exam (120 min) or 1 take-at-home exam		
Course achievement	for Organisation, Governance, Education / MA Social Sciences instead of the exami-nation: 1 written exam (120 min) or 1 take-at-home exam		

Contents

The content depends on the choice of specialisation:

In the Public Law specialisation, the basic principles of energy law are taught in Energy Law I and Energy Law II.
The Energy Law I course serves to present the fundamentals of energy law at European and German level. At the beginning of the course, the development of energy law in recent decades is presented. The lec-ture focuses on the regulation of grid operation and related topics such as unbundling, grid connection, grid utilisation and grid utilisation fees. The main contractual structures of energy supply relationships and the position of end consumers in the energy industry will be the subject of the course. A further focus is on the supply of end consumers, e.g. basic supply and contract adjustment options. The lecture is designed to be interactive and offers the opportunity for discussion. The topics discussed will be illustrated using numerous practical cases.

The Energy Law II lecture is primarily dedicated to the law of the ‘energy transition’. It complements the Energy Law I lecture - however, it is not essential to have attended Energy Law I beforehand. One focus of the lecture is the introduction to the law of renewable energies (EEG) including historical developments and European references, including expansion targets, connection and feed-in priority, tenders/tariffs and finan-cing, as well as an in-depth look at the specific legal situation of onshore and offshore wind turbines (includ-ing planning and approval, contract design). The event will also cover the most important legal foundati-ons for the expansion of the electricity grid (from the Energy Industry Act, EnLAG, NABEG, BBPlG). Finally, there will be an opportunity to look at current developments in energy law, e.g. with regard to sector coup-ling or green hydrogen. The lecture is designed to be interactive and offers the opportunity for discussion. The topics discussed will be illustrated using numerous practical cases.

Depending on the students' choice, the Civil Law specialisation teaches content from public procurement law, patent and trademark law and IT security law.
In the Patent and Trade Mark Law lecture, students learn the basics of German and European patent law, the relevant patenting requirements and procedures at the German Patent and Trade Mark Office (DPMA) and the European Patent Office (EPO). The requirements for patenting and the corresponding case law are then applied and analysed in particular to computer-implemented inventions, i.e. especially inventions that

contain a substantial amount of software. To a lesser extent, utility models and their differences to patents as well as registered designs and Community designs are also discussed.

The lecture on public procurement law deals with the scope and procedure of public procurement procedures as well as the legal protection options under public procurement law. It is based on the regulations of EU procurement law (cartel procurement law) in accordance with Part 4 of the GWB and the VgV. However, excursions into sub-threshold procurement law and the special procurement regimes of sector contracts, defence and security-related contracts and concessions will be made at appropriate points. An initial focus of the lecture is on the question of the cases in which public procurement law is applicable and, if applicable, which public procurement law regime is to be applied. On the basis of upper-threshold procurement law, an overview of the procedure is given, starting with the possible types of procedure, the requirements to be met by bidders and the subject matter of the contract, the necessary notices, through to the evaluation of bids and the conclusion of the award procedure. Finally, the legal protection options under public procurement law (primary and secondary legal protection) are dealt with in detail. The lecture takes into account current developments in public procurement law and deals with the respective topics using examples from public procurement law practice.

The IT security law lecture examines one of the key areas of the coming decades from a legal perspective. Students will learn about the legal framework conditions that govern the introduction and maintenance of appropriate IT protection standards. They will also learn how IT security risks are distributed at a contractual level. The unit conveys a holistic approach and enables students to independently develop scientific and practice-orientated solutions together with the relevant specialist literature in order to supervise the necessary information technology steps.

Objective qualification

The courses teach the following theoretical legal content in order to enable graduates to independently identify the relevant legal standards in their respective specialist area and to make subject-related legal decisions taking into account the current legal situation and to present these in a scientific and practice-oriented manner in writing and orally. Only the application-orientated integrative consideration of legal requirements and technical processes enables legally compliant company/product/production design (compliance).

After completing the module in the Public Law specialisation, students will be able to independently deal with the specialist laws in energy law and identify relevant legal norms. Here, technical examples from other lectures are taken up and jointly assessed on the basis of the existing legal situation. They will also learn the sector-specific "state of the art" with examples from technical practice.

After completing the module in the specialisation Civil Law, students will be able to independently find the specialist laws and relevant standards relevant to them and solve legal issues in public procurement law, patent and trademark law and/or IT security law by working with the law. After completing the module, students are sensitised to the content of the lectures in order to be able to participate in public procurement procedures and are sufficiently qualified to ask the right questions in practice in the context of patent and trademark law procedures.

Literature

For the Public Law specialisation:

Legal texts:

- Energierecht, dtv. Beck, 17. Aufl. 2022

Textbooks:

- Kühling/Rasbach/Busch, Energierecht, 5. Aufl. 2022
- Baumgart, Energierecht, 2022

For the civil law specialisation:

Legal texts:

Public procurement law, dtv. Beck, 25th ed. 2022
Patent and design law, dtv. Beck, 16th ed. 2022
Competition law, trade mark law and antitrust law, dtv. Beck, 44th ed. 2022
Textbooks:
Naumann, Public Procurement Law, 2nd ed. 2022
Burgi, Public Procurement Law, 3rd ed. 2021
Samer, The new patent law, 2022
Ann, Patent Law, 8th ed. 2022
Hornung/Schallbruch (ed.) IT Security Law, 2020

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Related courses

Rules for the choice of courses

One of the two specialisations must be chosen (the same specialisation that was taken in the orientation must be chosen).

Public law:
Energy Law 1
Energy Law 2
Civil law: (2 of the 3 courses must be chosen)
IT security law
Patent and trade mark law
Public procurement law

Students on the Sustainable Energy Technology Master's programme can only choose the Public Law specialisation.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Energy Law 1	2,0	Lecture	german
Energy Law 2	2,0	Lecture	german
IT Security Law	2,0	Lecture	german
Patent Law and Trademark Law	2,0	Lecture	german

Literature

- Patent- und Musterrecht (Verlag dtv-Beck)
- Wettbewerbsrecht und Kartellrecht (Verlag dtv-Beck)

Procurement Law	2,0	Lecture	german

Title	Specialisation Information Management		
Number	2222000010	**Module version**	
Shorttext		**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Susanne Robra-Bissantz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements	The module “Orientation Service Information Systems” must be successfully completed.		
Recommended requirements	The prerequisite for the module is basic knowledge in economics.		
Expected performance/ Type of examination			
Course achievement			

Contents

Selected content which students apply in a practical project building on the knowledge gained in the “Orientation Service Information Systems”:

- Servicification
- Role of IT in Service Processes
- Service Dominant Logic
- Digital Products
- Value in Interaction
- E-Services
- Service Design
- Service Ecosystems and Platforms
- Digital Economy
- Digital Management
- Cooperation and Collaboration
- Digital Collaboration

Objective qualification

Students understand the strategic relevance of information systems for companies in terms of operational tasks, people and technology. They are familiar with concepts for internal and/or inter-company IT-supported co-operation as well as their objectives and strategies in the context of strategic management. A possible specialisation is the view of application systems as e-services. Students acquire the technical and methodological knowledge and skills to develop, design, critically reflect on, present and at least partially technically implement strategically relevant IT-supported innovations for companies. Through project work, they are familiarised with working in teams and with modern media and are therefore able to apply their knowledge, make it sustainably accessible for themselves and expand it independently.

Literature

The course materials are available in Stud.IP; further reading can also be found there.

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

Title	Specialisation Management and Organisation Science		
Number	2223110	**Module version**	V2
Shorttext	WW-ORGF-11	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Unternehmensführung und Organisation
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Dietrich von der Oelsnitz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Recommended requirements	The module requires basic knowledge of business administration in the area of corporate management and organisation.		
Expected performance/ Type of examination	1 written Exam (90 min) or 1 take-at-home exam		
Course achievement	For Organisation, Governance, Education / MA Social Sciences instead of the examination: 1 written examination (90 minutes) or 1 take-at-home exam		

Contents

Depending on the chosen courses, practical and theoretical knowledge in the areas of organization, strategic knowledge management (including tools) and the management of teams and interorganizational networks are covered.

Objective qualification

After completing this module, students will have an in-depth understanding of the organization and processes within and between companies. They will learn how to systematically develop and maintain a company's knowledge base. Students will be able to explain the actions and behavior of organizational members and understand organizations as socio-technical systems.

Literature

- North, K.: Wissensorientierte Unternehmensführung, 4. Aufl., Wiesbaden 2005.
- Oelsnitz, D. von der/Hahmann, M.: Wissensmanagement, Stuttgart 2003.
- Probst, G./Raub, S./Romhardt, K.: Wissen managen, 5. Auflage, Wiesbaden 2006.
- Oelsnitz, D. von der (2005): Kooperation: Entwicklung und Verknüpfung von Kernkompetenzen, in: Zentes, J./ Swoboda, B./Morschett, D. (Hrsg.): Kooperationen, Allianzen und Netzwerke, 2. Aufl., Wiesbaden, S. 183-210

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Related courses			
Rules for the choice of courses			
Colloquium voluntary			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Networkmanagement	1,3	Lecture/Exercise	german
Literature			
Wird in der Vorlesung bekannt gegeben.			
Knowledge Management	2,8	Lecture/Exercise	german
Literature			
• North, K.: Wissensorientierte Unternehmensführung, 4. Aufl., Wiesbaden 2005. • Oelsnitz, D. von der/Hahmann, M.: Wissensmanagement, Stuttgart 2003. • Probst, G./Raub, S./Romhardt, K.: Wissen managen, 5. Auflage, Wiesbaden 2006.			
	1,0	Colloquium	german
Team and Network Management	4,0	Lecture/Exercise	german
Literature			
Wird in der Vorlesung bekannt gegeben.			

Title	Specialisation Economics		
Number	2212170	**Module version**	V2
Shorttext	WW-VWL-17	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Volkswirtschaftslehre
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Markus Ludwig
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam (90 min) or 1 term paper or 1 oral exam (30 min) or 1 take-at-home exam		
Course achievement	for Organisation, Governance, Education / MA Social Sciences instead of the examination performance: 1 written exam (90 min) or 1 term paper or 1 oral exam (30 min) or 1 take-at-home exam		

Contents

Due to a constantly growing amount of data with a socio-economic background, professional fields with a quantitative focus are becoming increasingly important. Quantitative issues include the evaluation of economic policy measures, the forecasting of economic development and the prediction of consumer behaviour based on socio-demographic characteristics.

The course Empirical Economic Research 2 takes this development into account. In the course, students acquire advanced knowledge of theoretical principles in the field of regression modelling. In particular, students are familiarised with methods from the fields of panel data and time series analysis. Furthermore, students sharpen their analytical skills in the field of empirical economic research and train statistical thinking. The lecture is practically orientated and students learn how to apply the methods using case studies from current research. The accompanying exercise takes place in the PC pool and students practise the handling of data sets and the practical application of panel data and time series methods using statistical software.

Students have in-depth knowledge of the basic methods in the field of panel data and time series analysis. They develop an intuitive approach to processing and analysing these specific forms of data. Students can apply the methods they have learnt in their own research projects and continue to interpret and classify research results in this area independently.

Selected topics:

Pooled cross-sectional data: Difference-in-differences estimation method, experiments
Panel data: Fixed-effects estimation method
Time series: AR models, ARMA models
Time series: forecasts

Objective qualification

Students have in-depth knowledge of the structure, functioning and efficiency of different market forms and can determine government measures to improve market outcomes. They are able to apply previously learnt

economic thinking to the political system. Students specialise in one area of economics and become familiar with the latest research findings.
Literature
• Wooldridge, Jeffrey: Introductory Econometrics: A Modern Approach, Cengage Learning, aktuelle Auflage. • Stock, James, Watson, Mark: Introduction to Econometrics, Pearson/Addison Wesley, aktuelle Auflage. • Hill, R. Carter, Griffiths, William E., Lim, Guay C.: Principles of Econometrics, Wiley, aktuelle Auflage.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Empirical Economics 2	4,0	Lecture/Exercise	german
Literature			
• Wooldridge, Jeffrey: Introductory Econometrics: A Modern Approach, Cengage Learning, aktuelle Auflage • Stock, James, Watson, Mark: Introduction to Econometrics, Pearson/Addison Wesley, aktuelle Auflage • Hill, R. Carter, Griffiths, William E., Lim, Guay C.: Principles of Econometrics, Wiley, aktuelle Auflage.			

Title	Spezialisation Services Management		
Number	2201000020	**Module version**	
Shorttext		**Language**	english german
Frequency of offer	every 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 / 5,0	**Module owner**	Prof. Dr. David Woisetschläger
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 portfolio or 1 take-home exam		
Course achievement	for Organization, Governance, Education / MA Social Sciences instead of the examination performance: 1 portfolio or 1 take-home exam		

Contents

Contents - depending on the course selection:

Strategic Brand Management & Brand Strategy Bootcamp
Contents of the lecture include
- Brand understanding and the importance of brands
- Measurement of brand associations
- Secondary brand associations
- Instruments for building brand associations
- Brand strategy and positioning
- Brand architecture
- Measuring brand performance
- International brand management
- Internal brand management
- Organizational aspects of brand management
- Sectoral specialties in retail, industrial goods and the luxury sector.

Contents of the exercise are:
Working on a real practical problem in the field of brand management in cooperation with a company partner.

Business Model Innovation & Service Innovation
Contents of the lecture include:
- Relevance, importance and understanding of business model innovations
- Organizational success factors and barriers
- Transformation of existing business models
- Methods of business model innovation
- Building blocks of business model innovation and related methods
- Sectoral aspects such as innovation in mobility

Contents of the exercise are:
Application of service innovation methods on a practical example.

Customer Relationship Management & Customer Analytics
Contents of the lecture include:
- Relevance, importance and understanding of customer relationship management
- Theoretical foundations of CRM
- Target indicators of CRM
- Lifecycle perspective of the customer relationship
- Acquisition and new customer management
- Customer loyalty programs
- Types and management of switching barriers
- Customer evaluation and segmentation
- Expansion of customer relationships
- Complaint management
- Termination prevention and reactivation management
- Customer data and privacy

Contents of the exercise include learning and applying methods
- to calculate customer value
- to evaluate the customer relationship (e.g. satisfaction, loyalty, recommendation)
- to calculate customer churn or the probability of churn
- to evaluate the success of promotions and reactivation measures

Objective qualification

Depending on the selected courses:

After successful participation, students will have a basic understanding of brands and knowledge of which aspects play a role in branding. In addition, they will understand and be able to critically discuss how brands are developed and positioned and which instruments are suitable for this. They can argue on the basis of theory why certain brand-related measures can be expected to have an effect and have methodological knowledge in order to measure the brand and quantify influencing factors. Students will be able to formulate precise problems and research questions based on a complex practical issue in the field of brand management and develop a solution to the problem using the content and methods learned in the lecture.

After successful participation, students have a basic understanding of business model innovation and know which factors play a role in the development of business model innovations. In addition, they will understand and be able to critically discuss how innovations are developed and which methods are suitable for this. They can argue on the basis of theory why certain corporate measures can be expected to have an effect on the success of innovation and have methodological knowledge to develop, evaluate and critically reflect on business model innovations themselves. Students can formulate precise problems and research questions based on a complex practical issue in the field of innovation management and develop solutions to problems using the content and methods learned in the lecture and taught in the exercise.

Students have an understanding of issues that arise in the context of recording, designing and evaluating customer relationships. Based on the concepts and methods they have learned, students will be able to independently record, conceptually structure and analyze customer relationship management issues in various industry contexts. They have methodological and application knowledge for the qualitative and quantitative analysis of customer and company data required to answer customer relationship management tasks.

Literature

Strategic Brand Management & Brand Strategy Bootcamp
- Keller, Kevin L. und V. Swaminathan (2019): Strategic Brand Management - Building, Measuring, and Managing Brand Equity, 5th ed., Prentice Hall
- Supplementary journal paper per chapter
- Lecture notes for download.
- Supplementary information and literature as bibliography and/or download for the exercise.

Business Model Innovation & Service Innovation

- Textbooks and further literature will be announced in the lectures
- Supplementary literature (PDF documents, lecture notes for download)

Customer Relationship Management & Customer Analytics
- Kumar, V. and Werner Reinartz (2018): Customer Relationship Management: Concept, Strategy, and Tools, 3. ed., Springer.
- Textbooks and further literature will be announced in the lectures
- Supplementary literature (PDF documents, lecture notes for download)

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Related courses

Rules for the choice of courses

Students must choose a course from the following program:
- Strategic Brand Management & Brand Strategy Bootcamp
- Business Model Innovation & Service Innovation
- Customer Relationship Management & Customer Analytics

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Business Model Innovation: Concepts and Applications	4,0	Lecture/Exercise	english

Literature

- Lehrbücher und weiterführende Literatur werden in den Veranstaltungen bekannt gegeben
- Ergänzende Literatur (PDF-Dokumente, Vorlesungsunterlagen zum Download)

Strategic Brand Management: Concepts and Applications	4,0	Lecture/Exercise	german

Literature

- Keller, Kevin L. und V. Swaminathan (2019): Strategic Brand Management - Building, Measuring, and Managing Brand Equity, 5th ed., Prentice Hall
- Ergänzende Journalpaper je Kapitel
- Vorlesungsunterlagen zum Download.
- Ergänzende Informationen und Literatur als Literaturverzeichnis und/oder zum Download zur Übung.

Customer Relationship Management and Customer Analytics	4,0	Lecture/Exercise	german

Literature

- Kumar, V. and Werner Reinartz (2018): Customer Relationship Management: Concept, Strategy, and Tools, 3. ed., Springer.
- Lehrbücher und weiterführende Literatur werden in den Veranstaltungen bekannt gegeben
- Ergänzende Literatur (PDF-Dokumente, Vorlesungsunterlagen zum Download

Interface Management & Technology: Technology-oriented Management	**15 ECTS**

Title	Energy Economy and Market Integration of Renewables		
Number	2423460	**Module version**	
Shorttext	ET-HTEE-46	**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

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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	Industrial Quality Management		
Number	2511210	**Module version**	
Shorttext	MB-IPROM-21	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Rainer Tutsch
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	none		
Expected performance/ Type of examination	1 examination element: written exam (120 min)		
Course achievement			

Contents

Quality management systems, Insight to quality management systems, Integrated management systems, Total Quality Management (TQM), Economy in quality management , Measurement systems and quality control system, Quality management in development and construction, Quality Function Deployment (QFD), Failure Mode and Effects Analysis (FMEA), Quality management in production engineering / operative quality planning, Quality management in acquisition, Quality management in fabrication, Statistical process control (SPC), Quality management at customers

Objective qualification

Students can explain the term quality and its relevance for a company on the basis of theoretical principles and practical examples. They can name several management systems. Furthermore, the students use suitable QM tools to illustrate the causes of problems and derive correlations from it. They can also describe various quality programs in Total Quality Management. Finally, students can analyze the economic efficiency of quality management systems using several calculation models. In addition, they can determine the quality of products using various measurement and testing methods and make a suitable selection of test parameters for this purpose. The students compare different QM methods in development and construction and distinguish between QM systems in procurement. They can explain QM tools used in production and draw a quality control chart. They are also able to define the importance of quality for the customer and evaluate it using methods for data acquisition and analysis like lifetime tests. Finally, the students can illustrate quality management systems along the supply chain.

Literature

- Pfeifer, T.: Qualitätsmanagement: Strategien, Methoden, Techniken. 3. Auflage. München: Hanser 2001
- Seghezzi, H.D.: Integriertes Qualitätsmanagement: der St. Galler Ansatz. 3. Auflage. München Hanser 2007
- Masing, W.: Handbuch Qualitätsmanagement. 5. Auflage. München: Hanser 2001

↑

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

Title	Strategic Product Planning		
Number	2516380	**Module version**	
Shorttext	MB-IK-38	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Thomas Vietor
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	Basic understanding of the product development- and product emergence process; basic knowledge of established methods for product development.		
Expected performance/ Type of examination	1 examination element: written exam, 120 minutes or oral exam, 30 minutes		
Course achievement	1 course achivement: presentation of the case study results during the excursion		

Contents

The lecture presents procedures and methods regarding strategic product planning sets the following priorities:
- Core aspects of innovation
- Core aspects of marketing
- Marketing tools
- Market-oriented planning of new products
- Company and competition analysis
- Analysis of Market and Competition
- Quantitative and qualitative objectives
- Strategies in product planning

The learned topics will be used by the students to edit case studies. The editing of the case studies is supported by the presentation workshop with the topic "presenting without digital slides". Within the workshop first results of the case studies are used to prepare posters and then being presented within multiple sessions. The completion of the case studies is the field trip and the presentation of the results of the case studies.

Objective qualification

The students are capable of: - describing the quality and market-oriented product planning and development in their function and interdisciplinary processes - applying methods of corporate and business unit planning for the development of products to achieve high customer satisfaction, secure the future and increase efficiency and effectiveness - deriving measures for successful strategic product planning from the core topic, the product planning, and product development process.

Literature

Franke, Hans-J.: Kooperationsorientiertes Innovationsmanagement : Ergebnisse des BMBF-Verbundprojektes GINA, "Ganzheitliche Innovationsprozesse in modularen Unternehmensnetzwerken", Berlin, 2005
Ehrlenspiel, K.: Kostengünstig entwickeln und konstruieren : Kostenmanagement bei der integrierten Produktentwicklung, Berlin, Heidelberg 2007. Pahl,
G./ Beitz, W.: Konstruktionslehre: 7. Auflage, Berlin, Heidelberg usw. 2007 Backhaus,

K/ Voeth M.: Industriegütermarketing, 9. Aufl., München,
2009 Belz, Chr.: Leistungssysteme zur Profilierung auswechselbarer Produkte, in: der Markt, Nr. 2 /1998, S.472-479. Belz,
Chr./ Schögel, M./ Tomczak, T.: Innovation Driven Marketing: Vom Trend zur innovativen Marketinglösung, Wiesbaden 2007.
Bleicher, K.: Das Konzept Integriertes Management: Visionen Missionen Programme, Frankfurt 2004.
Kramer, F.: Innovative Produktpolitik: Strategie, Planung, Entwicklung, Durchsetzung; Berlin, Heidelberg, New York, 1987. Kramer, F./ Kramer,
Ma.: Lean Management: Verschwendung erkennen und vermeiden - durch konsequente Ausschaltung nicht wertschöpfender Tätigkeiten, Band 4, in: Schriftenreihe des betriebswirtschaftlichen Ausschusses der Wirtschaftsverbände EBM und SV, Hagen/Düsseldorf 1994.
Kramer F./ Kramer, Ma.: Modulare Unternehmensführung 1: Kundenzufriedenheit und Unternehmenserfolg, Berlin, Heidelberg, New York 1994.
Schögel, M.: Kooperationsfähigkeiten im Marketing # Eine empirische Untersuchung, Wiesbaden 2006.

Remark
The module is divided into the following sections: lecture (2 semester hours per week/SWS), case studies (0,5 SWS), presentation workshop (0,5 SWS), and an excursion (1 SWS). To successfully complete the module, it is strongly advised to visit all of the dates. Enrollment will take place in an information event that will take place in the summer semester earlier.

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Related courses
Rules for the choice of courses
Lecture, presentation workshop, field trip and case studies must be taken respectively edited
Compulsory attendance

Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
	1,0	Excursion	german
	1,0	Project	german
	1,0	Seminar	german

Title	Production Planning and Control		
Number	2523060	**Module version**	
Shorttext	MB-IFU-06	**Language**	english
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	1 Examination element: written exam (120 min)		
Course achievement			

Contents

- Introduction to PPC
- Organization and flexibility of production networks
- Production Program Planning
- Production requirements planning
- In-house production planning and control
- Methods of the PPC
- External production planning and control
- Order Management
- PPC and ERP systems
- Innovations in the PPC

Objective qualification

Students # are able to explain the fundamental procedure for implementing and using ERP systems # are able to derive the essential advantages and disadvantages of the various methods of PPS on the basis of practical application examples # are able to evaluate and select suitable methods for specific applications in industrial practice using the relevant criteria # are able to evaluate the potentials of industry 4.0, by demonstrating the influences of a digital order processing process on PPS methods # are able to analyse the processes in companies on the basis of the target values of the PPS using suitable methods and derive improvements

Literature

- Luczak, H.; Eversheim, W.: Produktionsplanung und -steuerung: Grundlagen, Gestaltung und Konzepte. 2. Auflage. Berlin: Springer 2001.
- Kurbel, K.: Produktionsplanung und -steuerung im Enterprise Resource Planning und Supply Chain Management. 6. Auflage. München: Oldenbourg 2005.
- Lödding, H.: Verfahren der Fertigungssteuerung. Berlin: Springer 2005.

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

Title	Digitalisation in the Automotive Industry		
Number	2523270	**Module version**	
Shorttext	MB-IFU-27	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	150		
Class attendance (h)	30	**Self studying (h)**	120
Compulsory requirements			
Expected performance/ Type of examination	written exam (120 min)		
Course achievement			

Contents

- Overview Automotive industry
- Change of values from vehicle ownership to mobility
- Digital Natives as employees and customers
- Overview of corporate architectures of the automotive industry
- Overview of the relevant digitalization technologies
- Vision / Outlook 2030
- Procedure for digitization
- Change of corporate culture
- Design Thinking and Agile Requirements for IT
- Cloud and Microservices
- Application examples
- Future trends and outlook

Objective qualification

Students
#
- are able to derive the challenges of change and its consequences for the automotive industry using practical case studies and empirical research #
- can assess the transformation of the automotive industry from vehicle manufacturer to mobility service provider by dealing with new technologies and related fields of application #
- are able to name various technologies and transfer their application to the automotive industry based on theories and best practices #
  develop an awareness of new technologies in the automotive sector and an understanding of digitalisation as a driver of transformation based on presented future trends #
- are able to design different application scenarios by means of the transformation drivers

Literature

- Winkelhake, U.: Die digitale Transformation der Automobilindustrie: Treiber # Roadmap # Praxis. Berlin: Springer Vieweg 2017.
- Wedeniwski, S.: Mobilitätsrevolution in der Automobilindustrie. Berlin: Springer Vieweg 2015.

- Wayner, P.: Future Ride. 99 Ways the Self-Driving, Autonomous Car Will Change Everything from Buying Groceries to Teen Romance to Turning Ten to Having a Heart Attack ... to Simply Getting From Here to There. Amazon Digital Services LLC 2015.

↑

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

Title	Local Public Transport - Operation and Vehicles		
Number	4306420	**Module version**	
Shorttext	BAU-STD3-4	**Language**	german
Frequency of offer		**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration		**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			
Reinhardt: Öffentlicher Personennahverkehr			

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

Title	Realization and Financing		
Number	4310300	**Module version**	
Shorttext	BAU-STD4-3	**Language**	german
Frequency of offer		**Teaching unit**	
Module duration	2	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Tanja Kessel
Workload (h)			
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	2 exams (60 min. each), or 1 exam (60 min.) and 1 oral exam+ (15 Min.)		
Course achievement			

Contents

The operational instruments as well as the role and function of financing in the entire life cycle of real estate and infrastructure are taught. Particular attention is paid to the different incentive mechanisms of the actors and financing participants as well as the different public and private understanding of financing in the context of the normative framework.

Objective qualification

The students learn about the operational methods and tools with which a project is handled in a goal-oriented manner from an organisational, legal, technical, economic and deadline perspective.
In addition, the students learn about different financing structures in real estate and infrastructure management and are enabled to establish the role of financing in the life cycle and in the profitability assessment of real estate and infrastructure. They acquire skills for the development of
proposals for solutions and for the preparation of decisions.

Literature

Presentation slides of the lecture

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Related courses
Rules for the choice of courses
Project management in civil engineering can either be included in the module realisation and financing or in the module project management in hydraulic engineering.
Compulsory attendance

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

Title	Operating and Maintenance		
Number	4310310	**Module version**	
Shorttext	BAU-STD4-3	**Language**	german
Frequency of offer		**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration		**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			
Präsentationsfolien der Vorlesung			

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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
ESG in Real Estate Practice	2,0	Lecture	german
	2,0	Lecture	german

Title	Local Public Transport - Supply Planning		
Number	4310770	**Module version**	
Shorttext	BAU-STD4-7	**Language**	german
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Verkehr und Stadtbauwesen
Hours per Week / ECTS	0 / 6,0	**Module owner**	Prof. Dr. Bernhard Friedrich
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.) or oral exam (approx. 30 Min.) (in the Master's programme in Social Sciences as a course achievement)		
Course achievement	Term paper		

Contents

Public transport - service planning (VÜ)
- organizational and legal basics of the public transport system
- network planning in the context of settlement development
- public transport systems and their performance capabilities
- overview of circulation, vehicle and personnel planning
- distribution of tickets, the organization in transport associations and tariffing
- financing of public transport,
- marketing strategies in public transport
- differentiated modes of operation in public transport
- acceleration of public transport in urban road networks

Objective qualification

Students will gain knowledge of the interrelationships, systems and laws that must be taken into account when planning public transport services. They will be able to design or further develop and implement public transport services for urban and rural public transport, with the respective boundary conditions and systems to be taken into account. Public transport services are differentiated for road (IVS – Prof. Friedrich) and rail transport (IVE – Prof. Siefer).

Literature

-Differenzierte Bedienung im ÖPNV - Flexible Bedienungsweisen als Baustein eines markorientierten Leistungsangebotes,
-Blaue Buchreihe des VDV, Heft 15, DVV Media Group GmbH, April 2009.
-Stadtbahnsysteme Light Rail Systems. Grundlagen, Technik, Betrieb und Finanzierung. Blaue Buchreiche des VDV,
DVV Media Group GmbH, Juni 2014
-Richtlinien, Hinweise und Merkblätter der Forschungsgesellschaft für Straßen- und Verkehrswesen (www.fgsv-verlag.de).
-Reinhardt, W. Öffentlicher Personennahverkehr. Vieweg + Teubner Verlag. Springer Fachmedien Wiesbaden GmbH,
2012.

↑

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

Title	Bid Package and Construction Contract Law		
Number	4321030	**Module version**	
Shorttext	inaktiv	**Language**	german
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Bauwirtschaft und Baubetrieb
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Patrick Schwerdtner
Workload (h)	180 h		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

Basics of tendering/contract awarding/invoicing
Possibilities for translating design results into a general technical description, components and structures of procurement and contract documents, European and German procurement law, forms and procedure of procurement procedures of public clients, associated offers, rules for the evaluation of offers, online tenders, internet auction, specifics of privately financed PPP projects, defence and recovery as well as review procedures, invoicing of services, verifiability

Private building law and architectural law
Conclusion of the building contract, specifics of the architect/engineer contract, substitution, VOB- or BGB construction contracts, liability, warranty according to VOB/B and BGB, contractual penalty, guarantees

Objective qualification

After completing the module, students have in-depth knowledge of the general technical description as a link between architecture/design on the one hand and construction on the other hand. The students are able to create explicit and extensive tender documents and to review as well as implement them. They will be able to apply different procurement procedures (national and Europe-wide) as well as the rules of the procurement law protection from an employer’s and a contractor’s point of view (including the specifics of PPP projects). Furthermore, by conveying exemplary basic knowledge, the students will be able to settle and check simple invoices. Through the teaching of basic knowledge concerning of private building law and architectural law, students will be able to consider the relevant legal aspects for a successful construction preparation and execution.

Literature

Grundlagen der AVA
Folienhandout

Privates Bau- und Architektenrecht
Kurzfassungen und div. baurechtliche Literatur

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Related courses			
Rules for the choice of courses			
The module can be taken either as a module in the Basic Competences Area or as an elective module in the Specialisation Construction Engineering and Management.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture/Exercise	german
	2,0	Lecture	german

Title	Project Management and Project Organization		
Number	4321060	**Module version**	
Shorttext	BAU-STD3-8	**Language**	german
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Bauwirtschaft und Baubetrieb
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Patrick Schwerdtner
Workload (h)			
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (60 Min.) or oral exam (15 Min.)		
Course achievement			

Contents

Construction site management (V)]
General conditions for the activity; tasks and requirements (requirement profile); legal conditions (in Germany); client and involved authorities and institutions; contractor site manager; object supervisor; taking over a construction project; the field of activity as a contractor site manager; the field of activity as a client site manager; building site documentation; meetings and correspondence; measurement and billing; addendum; disrupted construction process; subcontractor deployment; performance reporting; negotiation management; project team; acceptance and warranty.

[Management of Construction Companies (V)]
Normative management (vision/mission; corporate culture and goals); strategic management (basic issues and characteristics; methods of strategy development; strategic tools); operational management (organization and process management); problem-solving methods.

[Workshop (Ü)]
Processing of a bid calculation; use of Building Information Modeling (BIM) in bid processing (tutorials); preparation and presentation of a bid; contract negotiation between client and contractor; extensive application of soft and social skills required.

[Special issues of disrupted construction projects (V)]
Identification and management of construction process disruptions; subcontract management; termination and partial termination; cooperative resolution approaches; contractor insolvency; defect management; control discussions.

Objective qualification

After completing the module, students are able to take on management tasks specific to construction sites in technical, organizational and economic terms for simple and medium-sized projects. Students will be able to differentiate between the various perspectives and responsibilities of the client and contractors' sides in the management of construction projects. Optionally, the students either take on the role of construction companies within a simulation game and can subsequently actively accompany an acquisition process for construction projects with regard to the calculation of the bid price and the negotiation of legal framework conditions with the help of the BIM methodology or, through the lecture Special Issues of Disturbed Con-

struction Projects, possess profound knowledge in dealing with unforeseeable events and developments of construction projects including in-depth legal competences for the assertion or assessment of resulting claims.
Literature
-Slides - Vergabe- und Vertragsordnung für Bauleistungen VOB/B - Würfele/Bielefeld/Gralla: Bauobjektüberwachung - Kochendörfer/Liebchen/Viering/Berner: Bau-Projekt-Management - Dillerup/Stoi, Unternehmensführung, 5. Auflage, München 2016

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

Title	Life Cycle Assessment for Sustainable Engineering		
Number	2545020	**Module version**	v2
Shorttext	MB-IWF2-02	**Language**	
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	
Workload (h)	150		
Class attendance (h)		**Self studying (h)**	
Compulsory requirements			
Recommended requirements	• Ideally, students have prior knowledge about matrix calculations (e.g. matrix multiplication) • Students know the empirical formulae of common substances (e.g. CO2, H20		
Expected performance/ Type of examination	written exam+ (120 min) or oral exam+ (30 min)		
Course achievement	presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.)		

Contents

- Necessity for quantifying environmental impacts
- Concept of life cycle thinking
- Sensitization for problem shifting
- Foundations and application of the life cycle assessment methodology
- Structure of an LCA according to the ISO 14040/14044
- Advantages and disadvantages of the methodology, applications and configurations

Objective qualification

Students...

- are able to conduct a Life Cycle Assessment (LCA) according to the ISO 14040/14044 standard
- are able to analyze an existing LCA study regarding the strength of its results and potential weaknesses of the study
- communicate LCA results to laypeople, and include relevant assumptions, limitations and boundary conditions in their communication
- know the modeling choices which need to be made as part of a LCA, and what should inform their decisions regarding these choices
- are able to identify, comprehend, refine and present relevant information regarding a given topic within the domain of LCA
- can, provided with adequate data, use LCA software to produce meaningful LCA results
- know how to organize themselves within a group project, which includes effective communication, sharing of workloads and the timely completion of tasks

Literature

- HAUSCHILD, Michael Z.; ROSENBAUM, Ralph K.; OLSEN, Stig Irvin. Life cycle assessment. Springer, 2018.
- ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework

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

Title	Life Cycle Assessment for Sustainable Engineering with Laboratory		
Number	2545030	**Module version**	v3
Shorttext	MB-IWF2-03	**Language**	
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 7,0	**Module owner**	
Workload (h)	210		
Class attendance (h)		**Self studying (h)**	
Compulsory requirements			
Recommended requirements	• Ideally, students have prior knowledge about matrix calculations (e.g. matrix multiplication) • Students know the empirical formulae of common substances (e.g. CO2, H20)		
Expected performance/ Type of examination	1 examination element: written exam+ (120 min) or oral exam+ (30 min)		
Course achievement	2 course achievements: 1. presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.) 2. protocol and presentation of the laboratory experiments		

Contents

- Necessity for quantifying environmental impacts
- Concept of life cycle thinking
- Sensitization for problem shifting
- Foundations and application of the life cycle assessment methodology
- Structure of an LCA according to the ISO 14040/14044
- Advantages and disadvantages of the methodology, applications and configurations
- scientific programming, modelling and data analysis tools to perform more comprehensive Life Cycle Assessment (LCA) studies for emerging technologies such as e-mobility

Objective qualification

Students…

- … are able to conduct a Life Cycle Assessment (LCA) according to the ISO 14040/14044 standard
- … are able to analyze an existing LCA study regarding the strength of its results and potential weaknesses of the study
- … communicate LCA results to laypeople, and include relevant assumptions, limitations and boundary conditions in their communication
- … know the modeling choices which need to be made as part of a LCA, and what should inform their decisions regarding these choices
- … are able to identify, comprehend, refine and present relevant information regarding a given topic within the domain of LCA
- … can, provided with adequate data, use LCA software to produce meaningful LCA results
- … know how to organize themselves within a group project, which includes effective communication, sharing of workloads and the timely completion of tasks
- … can, provided with adequate data, develop LCA models and program routines for impact assessment as well as visualization of results

Literature
HAUSCHILD, Michael Z.; ROSENBAUM, Ralph K.; OLSEN, Stig Irvin. Life cycle assessment. Springer, 2018. ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework
Remark
This lecture and the associated laboratory will be held in English.

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

Title	Energy Efficiency in Production Engineering		
Number	2522930	**Module version**	v2
Shorttext	MB-IWF-93	**Language**	english
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Christoph Herrmann
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)		
Course achievement	presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.)		

Contents

- Background and methods for the holistic planning, design and development of sustainable production systems
- Definition of the term and origin of sustainability in production
- Technologies and procedures for industrial data acquisition
- Energetic evaluation of production processes on the basis of various key figures
- Data analysis of production processes using Sankey diagrams in theory and practice
- Analysis of production processes based on an (energy) value stream analysis
- Analysis of the different levels of consideration of factories (production processes, technical building equipment, building envelope) and relevant material, energy and information flows
- Guest lectures from industry on relevant topics of sustainable production systems
- Gaining knowledge about energy flexibility in production
- Practice-oriented application of various methods to increase energy efficiency in the IWF's learning factory

Objective qualification

The students...

- ... explain the planning, design and development of sustainability-oriented production systems in different contexts
- ... assess different strategies (e.g. efficiency strategy) and principles (e.g. avoidance principle) of sustainable development in defined use cases on a laboratory scale
- ... evaluate existing production systems in economic, ecological and social dimensions
- ... are able to illustrate the results of various efficiency strategies to non-experts and to apply relevant assumptions, restrictions and framework conditions correctly
- ... design their own research questions within the team project, evaluate experiments and derive a presentation of the results of the research
- ... organize themselves in a team project and gain experience in relevant soft skills such as teamwork, communication and presentation skills
- ... analyze sustainability-oriented production systems within a given topic
- ... are able to select relevant fields of action and measures for sustainable production

Literature

Vorlesungsskript "Energy Efficiency in Production Engineering" mit ausführlichen Quellenangaben für das Selbstudium Herrmann, Christoph: Ganzheitliches Life Cycle Management, Berlin 2009 Dyckhoff, H. (2000): Umweltmanagement # Zehn Lektionen in umweltorientierter Unternehmensführung, Berlin: Springer-Verlag Berlin Heidelberg, 2000. Günther, H.-O.; Tempelmeier, H. (2005): Produktion und Logistik. 6., verb. Aufl., [Hauptbd.], Berlin: Springer-Verlag Berlin Heidelberg, 2005. Eversheim, W.; Schuh, G. (1999): Gestaltung von Produktionssystemen, VDI-Buch Nr. 3, Berlin: Springer-Verlag Berlin Heidelberg, 1999.
Remark
The course "Energy Efficiency in Production Engineering" is targeted in particular at students of mechanical engineering, industrial engineering, sustainable energy engineering, technology-oriented management, environmental engineering and other related courses. This lecture is held in English.

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

Title	Energy Efficiency in Production Engineering with Laboratory		
Number	2522940	**Module version**	v2
Shorttext	MB-IWF-94	**Language**	english
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 7,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	210		
Class attendance (h)	56	**Self studying (h)**	154
Compulsory requirements			
Expected performance/ Type of examination	written exam+ (120 min) or oral exam+ (30 min)		
Course achievement	2 course achievements: 1. presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.) 2. protocol and presentation of the laboratory experiments		

Contents

- Background and methods for the holistic planning, design and development of sustainable production systems
- Definition of the term and origin of sustainability in production
- Technologies and procedures for industrial data acquisition
- Energetic evaluation of production processes on the basis of various key figures
- Data analysis of production processes using Sankey diagrams in theory and practice
- Analysis of production processes based on an (energy) value stream analysis
- Analysis of the different levels of consideration of factories (production processes, technical building equipment, building envelope) and relevant material, energy and information flows
- Guest lectures from industry on relevant topics of sustainable production systems
- Gaining knowledge about energy flexibility in production
- Practice-oriented application of various methods to increase energy efficiency in the IWF's learning factory
- Evaluation of measures to increase energy flexibility through e.g. load profile analysis and energy portfolio

Objective qualification

The students...

- ... explain the planning, design and development of sustainability-oriented production systems in different contexts
- ... assess different strategies (e.g. efficiency strategy) and principles (e.g. avoidance principle) of sustainable development in defined use cases on a laboratory scale
- ... evaluate existing production systems in economic, ecological and social dimensions
- ... are able to illustrate the results of various efficiency strategies to non-experts and to apply relevant assumptions, restrictions and framework conditions correctly
- ... design their own research questions within the team project, evaluate experiments and derive a presentation of the results of the research
- ... organize themselves in a team project and gain experience in relevant soft skills such as teamwork, communication and presentation skills

- ... analyze sustainability-oriented production systems within a given topic
- ... are able to select relevant fields of action and measures for sustainable production

Through the lab, the students...
- ... become more confident with the topic of energy flexibility introduced in the lecture
- ... are able to use energy measuring devices independently
- ... understand the influence of volatile renewable energies and of environmental factors on production within a case study
- ... identify energy flexibilization potentials in production within a real example in the BatteryLab Factory

Literature

Vorlesungsskript "Energy Efficiency in Production Engineering" mit ausführlichen Quellenangaben für das Selbstudium

Herrmann, Christoph: Ganzheitliches Life Cycle Management, Berlin 2009

Dyckhoff, H. (2000): Umweltmanagement # Zehn Lektionen in umweltorientierter Unternehmensführung, Berlin: Springer-Verlag Berlin Heidelberg, 2000.

Günther, H.-O.; Tempelmeier, H. (2005): Produktion und Logistik. 6., verb. Aufl., [Hauptbd.], Berlin: Springer-Verlag Berlin Heidelberg, 2005.

Eversheim, W.; Schuh, G. (1999): Gestaltung von Produktionssystemen, VDI-Buch Nr. 3, Berlin: Springer-Verlag Berlin Heidelberg, 1999.

Remark

The course "Energy Efficiency in Production Engineering" is targeted in particular at students of mechanical engineering, industrial engineering, sustainable energy engineering, technology-oriented management, environmental engineering and other related courses.
This lecture is held in English.

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Related courses

Rules for the choice of courses

All courses have to be attended.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	2,0	Lecture	english
	1,0	Laboratory	english
	1,0	Team Project	english

Title	Future Production Systems		
Number	2522770	**Module version**	
Shorttext	MB-IWF-77	**Language**	english
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	150		
Class attendance (h)	45	**Self studying (h)**	105
Compulsory requirements			
Recommended requirements	Communication in written and spoken English		
Expected performance/ Type of examination	1 examination element: presentation (30 min) 1 course achievement: written elaboration		
Course achievement			

Contents

- Manufacturing is experiencing constant change under the influence of various trends and dissemination of innovative technologies
- Awareness is rising of the importance of concepts for sustainable production and social changes (e.g. demographic change, urbanisation)
- The seminar fosters the inderstanding of the necessary changes of future production systems
- It aims at an interdisciplinary understanding of factories and production systems and the handling of conflicting goals
- Important skills, such as group work, presentation techniques and scientific writing, presentation and discussion in technical English, are imparted in the seminar

Objective qualification

Students

- can discuss future trends in production, such as digitalisation in production, urban production or the sustainable design of production systems
- learn to derive research questions based on future trends in production
- design a fictitious scientific publication based on future trends in production
- can describe and apply the process of a review
- can present and argue their elaborated results within the frame of a fictitious conference situation using appropriate methodological skills
- can apply methodological skills, such as time and project management
- develop social skills through self-organised group work
- develop self competences (e.g. time management)

Literature

1. Herrmann, C., Schmidt, C., Kurle, D., Blume, S., & Thiede, S. (2014). Sustainability in Manufacturing and Factories of the Future. International Journal of precision engineering and manufacturing - Green Technology, 1(4), 283-292.
2. Herrmann, C., Blume, S., Kurle, D., Schmidt, C., & Thiede, S. (2015). The Positive Impact Factory#Transition from Eco-efficiency to Eco#effectiveness Strategies in Manufacturing. Procedia CIRP, 29, 19-27.

3. Weitere Literatur wird in der Vorlesung bekannt gegeben

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	3,0	Seminar	english

Title	Research and Innovation Management		
Number	2522980	**Module version**	v2
Shorttext	MB-IWF-98	**Language**	
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	written exam+ (120 min) or oral exam+ (30 min)		
Course achievement	Presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.)		

Contents

- Current trends in the funding of innovation
- Risks and responsibility in research projects
- Internationally networked research and funding landscape
- Management and quality assurance in research
- Strategy process and strategy audit
- R&D project management and evaluation
- Financial, budget and project calculation
- Use and transfer of R&D results
- Innovation Management
- Patents and licences
- Spin-offs
- R&D ecosystem
- Innovation ecosystem
- Risks of research
- Responsibility in science
- ERA, DARPA and international research networks
- R&D portfolio development and technology foresight

Objective qualification

Students
can
- comment on the methods of planning and evaluation of research
- describe trends and indicators of European and international research and innovation systems
- present the idea of research alliances
- explain the exploitation paths of patenting and licensing
- evaluate an R&D portfolio planning

Literature

Lothar Behlau. Forschungsmanagement: Ein praktischer Leitfaden. De Gruyter, 2017

Business Model Generation: Ein Handbuch für Visionäre, Spielveränderer und Herausforderer. Campus Verlag GmbH, 2010

↑

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

Title	Factory Planning		
Number	2522960	**Module version**	v2
Shorttext	MB-IWF-96	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	written exam+ (120 min) or oral exam+ (30 min)		
Course achievement	presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.)		

Contents

- Future of Factories
- Constituting elements of a factory
- Planning process
- Choice of location
- General building development
- Building structure planning
- Organizational structures of manufacturing
- Material flow and material handling
- Layout planning
- Planning of technical buidling services (TBS)
- Detailed planning of the production
- Sustainable operation of the factory
- Digitalization of the factory

Objective qualification

Students
#
- are able to describe and explain current trend, challenges and requirements of the factories using selected case studies #
- are able to categorize different factory planning cases, factory types, factory strategies and factory levels on the basis of socio-technical dimensions and analyze the effects on the factory planning process #
- are able to solve relevant planning and design tasks with reference to the VDI guideline 5200 #
- are able to independently select suitable tools, methods and models based on standard procedures (z. e.g. according to the VDI factory planning reference process) #
- are able to use methods and tools to design a factory structure and factory organization #
- are able to derive the effects of changed conditions for existing factories by tuning and adapting

Literature

1. Wiendahl H-P, Reichardt J, Nyhuis P (2014): Handbuch Fabrikplanung: Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktionsstätten. München: Carl Hanser

2. Schenk M, Wirth S, Müller E (2014): Fabrikplanung und Fabrikbetrieb: Methoden für die wandlungsfähige, vernetzte und ressourceneffiziente Fabrik. 2. Aufl. Berlin: Springer Vieweg

↑

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

Title	Factory Planning with Laboratory		
Number	2522970	**Module version**	v2
Shorttext	MB-IWF-97	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	5 / 7,0	**Module owner**	Prof. Dr. Christoph Herrmann
Workload (h)	210		
Class attendance (h)	70	**Self studying (h)**	140
Compulsory requirements			
Expected performance/ Type of examination	written exam+ (120 min) or oral exam+ (30 min)		
Course achievement	2 course achievements: 1. presentation and/or written report in the context of a teamproject (On application, the result of the course achievement is taken into account in the assessment of the written examination+ or of the oral examination+, respectively, and can account maximum 20% of the respective grade.) 2. protocol and presentation of the laboratory experiments		

Contents

- Future of Factories
- Constituting elements of a factory
- Planning process
- Choice of location
- General building development
- Building structure panning
- Organizational structures of manufacturing
- Material flow and material handling
- Layout planning
- Planning of technical buidling services (TBS)
- Detailed planning of the production
- Sustainable operation of the factory
- Digitalization of the factory
- Introduction to virtual factory planning
- Introduction to different digital planning tools
- Applying planning tools in a practice setting

Objective qualification

Students
#
- are able to describe and explain current trend, challenges and requirements of the factories using selected case studies #
- are able to categorize different factory planning cases, factory types, factory strategies and factory levels on the basis of socio-technical dimensions and analyze the effects on the factory planning process #
- are able to solve relevant planning and design tasks with reference to the VDI guideline 5200 #
- are able to independently select suitable tools, methods and models based on standard procedures (z. e.g. according to the VDI factory planning reference process) #
- are able to use methods and tools to design a factory structure and factory organization #
- are able to derive the effects of changed conditions for existing factories by tuning and adapting #

- have acquired extended knowledge about decision-making contexts in companies. #
- have their decision-making competence is strengthened by taking on different roles and experimenting with alternatives in the business games. #
- are able to transfer the experiences from the business games to real situations from everyday business life.

Literature

1. Wiendahl H-P, Reichardt J, Nyhuis P (2014): Handbuch Fabrikplanung: Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktionsstätten. München: Carl Hanser
2. Schenk M, Wirth S, Müller E (2014): Fabrikplanung und Fabrikbetrieb: Methoden für die wandlungsfähige, vernetzte und ressourceneffiziente Fabrik. 2. Aufl. Berlin: Springer Vieweg

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Related courses

Rules for the choice of courses

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	2,0	Lecture	german
	1,0	Exercise	german
Factory planning lab	2,0	Laboratory	german

Title	Health Infomation Systems B		
Number	4217640	**Module version**	V2
Shorttext	INF-MI-64	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Peter L. Reichertz Institut für Medizinische Informatik
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Thomas Deserno
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 graded work: Written exam (90 minutes) or oral exam (30 minutes) or term Paper or presentation or creation and documentation of computer programs or experimental work or portfolio or Take-Home-Exam.		
Course achievement			

Contents

- Introduction (importance of information processing, especially in hospitals, relevance of information management)
- Basic concepts (information systems, especially hospital information systems)
- Architecture and functionality of information systems
- Quality of information systems
- Strategic information management

Part of the course will be taught in English.

Objective qualification

After completing the module, students will have acquired knowledge of strategic information management methods and the functionality and architecture of information systems, particularly in the healthcare sector.

Literature

- Winter,A.; Haux, R. et.al.: Health Information Systems: Architectures and Strategies. Springer Verlag, 2011.

- IMIA Yearbook of Medical Informatics (erscheint jährlich)

- weitere aktuelle Literatur wird im Rahmen der Vorlesung bekanntgegeben

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Health Infomation Systems B	2,0	Lecture	german
Literature			
- Winter,A.; Haux, R. et.al.: Health Information Systems: Architectures and Strategies. Springer Verlag, 2011. ISBN-13: 978-1849964401 - IMIA Yearbook of Medical Informatics (erscheint jährlich) - weitere aktuelle Literatur wird im Rahmen der Vorlesung bekanntgegeben			
	2,0	Exercise	german

Title	Planning and Development		
Number	4310290	**Module version**	
Shorttext	BAU-STD-24	**Language**	
Frequency of offer		**Teaching unit**	
Module duration	2	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Tanja Kessel
Workload (h)			
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Exam (60 min. or 90 min.) and 1 oral exam (15 min.), or 2 exams (60 min. or 90 min. each), or 2 oral exams (15 Min. each)		
Course achievement			

Contents

The conceptual and strategic aspects of the development and planning of real estate projects are taught. In conjunction with the relevant methods and tools, these form the basis for the diverse management tasks and decisions in the development phase of real estate. This setting of the course for the subsequent life cycle phases is based on the business and strategic requirements of the owners, user requirements, innovation content and sustainability.

Objective qualification

The students receive profound knowledge for a sustainable and life-cycle-oriented management of real estate in the development and planning phase. They are enabled to understand the incentive mechanisms and risk structures of the different actors and to take them into account in the respective management tasks. In addition, they acquire the ability to carry out their own analyses and calculations, for example economic feasibility studies and market value assessments.

Literature

Presentation slides of the lecture, exercises, literature for further reading

↑

Related courses

Rules for the choice of courses

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	2,0	Block course	german

	2,0	Lecture/Exercise	german

Title	Waste and Resource Management		
Number	4398320	**Module version**	
Shorttext	BAU-STD-65	**Language**	
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Dr. Kai Münnich
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.) or oral exam (approx. 30 Min.) (in the Master's programme in Social Sciences as a course achievement)		
Course achievement			

Contents

Waste management concepts; acquisition logistics; plant and process technology (with focus on biological processes; methods for process control and monitoring; emission control; product development; secondary raw materials; methods for quality control of secondary raw materials; design principles, plant planning and design, and waste analytics.

Objective qualification

Students acquire in-depth knowledge of tasks and solution methods of municipal and industrial waste and resource management as well as material flow-related recycling management. The special focus is on biological treatment and recycling processes for municipal waste. Here, required work steps and methods for the implementation of management measures and plant technologies are learned.
Evaluation methods for describing and assessing economic, ecological and social impacts are taught and applied. Special knowledge in the field of the use of regenerative energies from municipal waste is acquired. In this lecture, students will be able to use their acquired knowledge to evaluate waste management concepts and to perform rough measurements of selected process steps/aggregates

Literature

Detailed script, Powerpoint slides,

↑

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

	4,0	Lecture/Exercise	german

Interface Management & Technology: Methods	**10 ECTS**

Title	Entrepreneurship for Engineers		
Number	2537280	**Module version**	
Shorttext	MB-IWF-52	**Language**	
Frequency of offer	every term	**Teaching unit**	Fakultät für Maschinen-bau
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Reza Asghari
Workload (h)	150		
Class attendance (h)	30	**Self studying (h)**	120
Compulsory requirements	Requirements for "TechnologyBusiness Model Creation": Successful participation in the "Technology Entrepreneurship" event/lecture		
Expected performance/ Type of examination	Writing paper		
Course achievement	Presentation: The participants have to generate a business model for a research project in teams #especially within the area of production technology and systems technology. Furthermore they have to present the milestones in the plenary session. Moreover they have to record their results by writing a research paper. The research project will be given by the chair. The institutes will present the research projects in the plenary session.		

Contents

The economical relevance of innovative technology companies is explained in context of knowledge economy after an introduction in the topic Entrepreneurship. Furthermore the role and function of technology based start-ups as initiator and supporter innovations are analyzed. In addition an involvement with the topic #Business model# and Business model innovation takes place: especially the components of a business model are defined and systematized. Afterwards elements and methods are presented to generate business models. So students have to generate own business ideas and business models with their acquired skills. As part of the course we cooperate with several institutes and research establishments; especially with the institute for Connecting and Welding, Technologies surface engineering, micro mechanics, institute for Factory operation and Business Research. The participants have the opportunity to deal with the utilization of future-oriented research projects and to draft suitable business models on a basis within Business Model Canvas.

Objective qualification

At the beginning of the course, theoretical content is taught in the lecture Technology Entrepreneurship (winter semester). In the following summer semester, the students are asked to apply the acquired knowledge as teams in the seminar Technology Business Model Creation by generating their own business ideas based on scientific and technological research results and to put them into practice. (self-regulated learning). After completing the module, students have knowledge and understanding of technology-oriented companies in the entrepreneurship environment. They have developed a basic knowledge regarding the analysis and application of business models in the field of e-entrepreneurship, high-tech entrepreneurship and knowledge-oriented business start-ups. The students are able to independently analyze, evaluate and optimize subject-specific issues and to present these in writing and orally in a scientific and practice-oriented manner by discussing the relevant specialist literature. The students have developed their communication skills through discussions on general and current topics related to entrepreneurship and have trained

their cooperation and teamwork skills through group work. The students are able to identify and develop a business idea and set up a business model.

Literature

Faltin, Günter: Kopf schlägt Kapital, 2010, Berlin
Faltin, Günter: Wir sind das Kapital, 2015, Berlin
Fueglistaller/Volery et al.: Entrepreneurship, 5. Auflage, 2020
Grichnik, D. et al.: Entrepreneurship, 2. Auflage, 2017
Keese, Christoph: Silicon Valley # Was aus dem mächtigsten Tal der Welt auf uns zukommt, 2014
Matzler, K./Bailom, F. u.a., Digital Disruption, 2016, München
Röpke, Jochen: Der lernende Unternehmer, 2004, Marburg
Gassmann, O./Frankenberger, K./Csik, M.: Geschäftsmodelle Entwickeln, 2017
Vorlesungsfolien: Die Vorlesungsmaterialien werden in Stud.IP zum Download bereitgestellt.

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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	Seminar	german

Title	Human Resources		
Number	17119960 V2	**Module version**	V2
Shorttext		**Language**	german
Frequency of offer	every term	**Teaching unit**	Fakultät für Lebenswissenschaften
Module duration		**Institution**	Institut für Psychologie
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Simone Kauffeld
Workload (h)	150		
Class attendance (h)	60	**Self studying (h)**	90
Compulsory requirements			
Expected performance/ Type of examination			
Course achievement			

Contents

Objective qualification

Literature

Kauffeld, S. (2019). Arbeits-, Organisations- und Personalpsychologie für Bachelor. (3. überarbeitete Auflage). Berlin: Springer.

Kauffeld, S. (2016). Nachhaltige Personalentwicklung und Weiterbildung. Betriebliche Seminare und Trainings entwickeln, Erfolge messen, Transfer sichern (2. überarbeitete Auflage). Berlin: Springer.

↑

Related courses

Rules for the choice of courses

Compulsory attendance

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

	2,0	Lecture	german
Literature			
Wird in der Lehrveranstaltung bekannt gegeben.			

	2,0	Lecture	german

	2,0	Lecture	german

Title	Innovations		
Number	2299350	**Module version**	
Shorttext	WW-STD-35	**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Wirtschafts-informatik - Abteilung Service-Informationssy-steme
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Susanne Robra-Bissantz
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examina-tion	1 portfolio examination (20 min)		
Course achievement			

Contents

Selected content - depending on the event selection:

- Innovation management
- Open Innovation
- Technology Push and Market Pull
- Cooperative creativity
- Integrative conception and realisation
- Business model and business plan

Objective qualification

Students are familiar with innovation management approaches and methods in this area (creation, conception, implementation). They can identify and abstract innovation management problems in technical contexts and develop solutions independently in a team. They communicate these solutions, discuss them in the group and apply them.

Literature

will be announced at the beginning of the event.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
ToM Method	4,0	Project	german

Title	Management of Industrial Enterprises		
Number	2299690	**Module version**	
Shorttext	WW-STD-34	**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Department Wirtschafts-wissenschaften
Hours per Week / ECTS	3 / 5,0	**Module owner**	Studiendekan der Wirt-schaftswissenschaften
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examina-tion	1 portfolio examination		
Course achievement			

Contents

Knowledge of the business and legal relationships involved in managing a company based on practical cases:

Internal management of a company on the basis of legal rules
Financing instruments of a company in the international trading business
Credit insurance for distribution contracts
Limits of entrepreneurial freedom: corporate governance, supervisory board and works council responsi-bilities

Objective qualification

Students understand the business and legal interrelationships involved in managing a technology company. Practical examples and courses enable students to put what they have learnt into practice.

Literature

- Macharzina, Klaus/Wolf, Joachim, Unternehmensführung, Das internationale Managementwissen ? Kon-zepte ? Methoden ? Praxis, 7. vollständig überarbeitete und erweiterte Auflage 2010

2010, Gabler Verlag; Marschollek, Günter;Arbeitsrecht 19., neu bearbeitete Auflage 2012
2012, Alpmann und Schmidt; Schaub, Günter Arbeitsrechtshandbuch 14. neu bearbeitete Auflage 2011
2011, C.H. Beck

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Related courses			
Rules for the choice of courses			
Students have to choose 2 courses. Colloquia are voluntary.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Applied Game Theory	2,0	Lecture	german
International Economics	2,0	Lecture	german
Literature			
Paul R. Krugman, Maurice Obstfeld und Marc J. Melitz. Internationale Wirtschaft: Theorie und Politik der Außenwirtschaft, Pearson 11. aktualisierte Auflage, 2019.			
	2,0	Block course	german
Methods of Data Science for Business	1,0	Lecture	english
	1,0	Colloquium	english
Entrepreneurial Acting in a Technology Group of Companies - based on German and International Law	2,0	Lecture	german
Literature			
• Macharzina, Klaus/Wolf, Joachim, Unternehmensführung - Das internationale Managementwissen – Konzepte – Methoden – Praxis, 7. vollständig überarbeitete und erweiterte Auflage 2010, Gabler Verlag • Marschollek, Günter, Arbeitsrecht, 19., neu bearbeitete Auflage 2012, Alpmann und Schmidt • Schaub, Günter, Arbeitsrechtshandbuch, 14. neu bearbeitete Auflage 2011, C.H. Beck • Wolf, Rosanna, Die Kunst, Menschen zu führen, 5. Auflage 2010, Rowohlt Taschenbuch Verlag • Jacques Pateau, Die seltsame Alchemie in der Zusammenarbeit von Deutschen und Franzosen,1999, Campus Verlag			
Technology & Sustainability Risk Management	2,0	Lecture	german
	3,0	Lecture	german

Title	Management of Industrial Enterprises		
Number	2299700	**Module version**	
Shorttext	WW-STD-34	**Language**	english german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	2	**Institution**	Department Wirtschafts-wissenschaften
Hours per Week / ECTS	8 / 10,0	**Module owner**	Studiendekan der Wirt-schaftswissenschaften
Workload (h)	300		
Class attendance (h)	112	**Self studying (h)**	188
Compulsory requirements			
Expected performance/ Type of examina-tion	1 Portfolio examination		
Course achievement			

Contents

Knowledge of the business and legal connections in the management of a company based on practical cases:
- Internal governance of a company on the basis of legal rules
- Financing instruments of a company in the international trading business
- Credit insurance for distribution contracts
- Limits of entrepreneurial freedom: corporate governance, supervisory board and works council responsibilities

Objective qualification

Students understand the business and legal interrelationships involved in leading a technology company. Practical examples and courses enable students to apply their knowledge in practice.

Literature

- Macharzina, Klaus/Wolf, Joachim, Unternehmensführung, Das internationale Managementwissen ? Konzepte ? Methoden ? Praxis, 7. vollständig überarbeitete und erweiterte Auflage 2010

2010, Gabler Verlag
Marschollek, Günter
Arbeitsrecht
19., neu bearbeitete Auflage 2012
2012, Alpmann und Schmidt
Schaub, Günter
Arbeitsrechtshandbuch
14. neu bearbeitete Auflage 2011
2011, C.H. Beck

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Related courses			
Rules for the choice of courses			
4 courses of your choice must be attended. Colloquia are voluntary.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
Applied Game Theory	2,0	Lecture	german
International Economics	2,0	Lecture	german
Literature			
Paul R. Krugman, Maurice Obstfeld und Marc J. Melitz. Internationale Wirtschaft: Theorie und Politik der Außenwirtschaft, Pearson 11. aktualisierte Auflage, 2019.			
	2,0	Block course	german
Methods of Data Science for Business	1,0	Lecture	english
	1,0	Colloquium	english
Entrepreneurial Acting in a Technology Group of Companies - based on German and International Law	2,0	Lecture	german
Literature			
• Macharzina, Klaus/Wolf, Joachim, Unternehmensführung - Das internationale Managementwissen – Konzepte – Methoden – Praxis, 7. vollständig überarbeitete und erweiterte Auflage 2010, Gabler Verlag • Marschollek, Günter, Arbeitsrecht, 19., neu bearbeitete Auflage 2012, Alpmann und Schmidt • Schaub, Günter, Arbeitsrechtshandbuch, 14. neu bearbeitete Auflage 2011, C.H. Beck • Wolf, Rosanna, Die Kunst, Menschen zu führen, 5. Auflage 2010, Rowohlt Taschenbuch Verlag • Jacques Pateau, Die seltsame Alchemie in der Zusammenarbeit von Deutschen und Franzosen,1999, Campus Verlag			
Technology & Sustainability Risk Management	2,0	Lecture	german
	2,0	Seminar	english
	3,0	Lecture	german

Title	Strategic Technology Management		
Number	2299440	**Module version**	
Shorttext	WW-STD-44	**Language**	german
Frequency of offer	irregular	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Department Wirtschafts-wissenschaften
Hours per Week / ECTS	4 / 5,0	**Module owner**	Studiendekan der Wirt-schaftswissenschaften
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examina-tion	1 Klausur (90 min)		
Course achievement	1 Referat		

Contents

Selected content - depending on the course selection:
- Subject and process of strategic technology and innovation management
- Strategic analysis and planning tools (e.g. technology and innovation field portfolio)
- Technology- and market-orientated corporate strategies
- R&D management
- Success factors of innovation projects
- Interface management
- Innovation management and organisational corporate change

Objective qualification

Students acquire the ability to analyse strategic problems of technology and innovation management in technology-intensive companies and to develop and implement solutions based on this.

Literature

- Albers, Sönke/Gassmann, Oliver (Hrsg.): Handbuch Technologie- und Innovationsmanagement, 2. Aufl., Wiesbaden 2011: Gabler;
- Gerpott, Torsten J.: Strategisches Technologie- und Innovationsmanagement, 2. Aufl., Stuttgart 2005: Schäffer-Poeschel;
-Gerybadze, Alexander: Technologie- und Innovationsmanagement, München 2004: Vahlen.

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

Title	Transport Policy and Social Mobility		
Number	1815040	**Module version**	V1
Shorttext	SW-IPol-04	**Language**	german
Frequency of offer	irregular	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1 Semester	**Institution**	Institut für Vergleichende Regierungslehre und Politikfeldanalyse
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Nils C. Bandelow
Workload (h)	150		
Class attendance (h)	60	**Self studying (h)**	90
Compulsory requirements			
Expected performance/ Type of examination	1 examination performance: 1 oral examination (30 min) or 1 presentation with elaboration (up to 15 pages). After consultation with the lecturers.		
Course achievement	1 academic achievement: 1 presentation		

Contents

Mobility processes in modern societies
The extent and manifestations of spatial mobility and transport are directly related to the structural characteristics of functionally differentiated, socially heterogeneous societies organised according to the division of labour. The structural change from traditional to modern societies has resulted in the migration of a large proportion of the population from rural areas to the growing cities. Current processes of Europeanisation and globalisation also promote or force migration and, not least, transnational mobility processes. In this sense, a high degree of social mobility should be seen as a constitutive feature of the social structure of modern societies. Functional social differentiation implies the separation of the sphere of production from the sphere of reproduction, which is reflected in the spatial separation of working and living and other areas of life such as education and leisure. Against this background, in addition to the fundamental characteristics of the infra- and social structure of modern societies, the mobility behaviour of individuals and households will be developed and discussed in the context of the demands of the world of work, leisure needs and lifestyle preferences.

Governance in transport policy
The observation that differentiating mobility needs characterised by individualisation are no longer limited to local authorities, but extend beyond the design and legitimation spaces of traditional political control, leads to the conclusion that political design processes of mobility and transport do not take place solely through the traditional institutions and actors of national political systems. With the emergence of new social spaces, which at the same time form mobility spaces, new political arenas are also developing. The phenomena referred to as regionalisation, Europeanisation or transnationalisation, for example, are to be examined with regard to the shaping of mobility and transport. Social trends, such as demographic change and individualisation, as well as central political models will be examined with regard to innovation potentials and restrictions for transport policy. The question of the innovative capacity of transport sectors and design areas will be discussed against the background of the globalisation of markets, climate change, the increasing volume of traffic and consumption of resources, and the conditions under which innovations arise will be worked out.

Objective qualification

The module builds on previous knowledge of social science transport research and aims to deepen this knowledge. Students will understand the connections between mobility needs, social living conditions and spatial design as well as their impact on the development of transport. To this end, the theoretical and methodological foundations of transport are discussed and reflected upon and linked to phenomena that determine transport in its observable forms. Students will gain an in-depth understanding of the recognisable effects of transport on the economic, scientific and political spheres of society. Using case studies, they are able to name and systematise the conditions for the development of transport and its effects. Students will be taught the interdisciplinary dimension of transport research. The question of how innovations arise in the transport sector picks up on this perspective and is just as relevant for understanding development paths in mobility research as it is for the ability to shape mobility. Students will be able to identify innovation conditions, recognise and assess the interests of the players and potential conflicts in the field. They will be able to name and evaluate structures, institutions, theories and areas of conflict in transport policy and economics. The aim is to provide students with an analytical understanding of transport as a social practice and transport policy as social policy and thus form the basis for the in-depth content of mobility and transport.

Literature

- Blättel-Mink, Birgit 2006: Kompendium der Innovationsforschung, Wiesbaden: VS Verlag.
- Hof, Hagen/Wengenroth, Ulrich 2007 (Hrsg.): Innovationsforschung: Ansätze, Methoden, Grenzen und Perspektiven, Münster: LIT Verlag.
- Scheiner, Joachim, 2009: Sozialer Wandel, Raum und Mobilität – Empirische Untersuchungen zur Subjektivierung der Verkehrsnachfrage.
- Schöller, Oliver/Canzler, Weert/Knie, Andreas, 2007 (Hrsg.): Handbuch Verkehrspolitik. Wiesbaden: VS Verlag. Tully, J. Claus/Baier, Dirk 2006: Mobiler Alltag – Mobilität zwischen Option und Zwang – Vom Zusammenspiel biographischer Motive und sozialer Vorgaben. Wiesbaden: VS Verlag.

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Related courses

Rules for the choice of courses

[1] Mobility processes in modern societies
[2] Governance in transport policy
The courses must be attended together in one semester.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
Governance in Transport Policy	2,0	Seminar	german

Literature

International and national institutions and think tanks provide easily accessible documents and current studies for working on the topic clusters in the two seminars "Mobility Processes in Modern Societies" and "Governance of Transport Policy".

Selected examples are:
- Mercator Institute for Climate and Common Goods (MCC)
- Potsdam Institut für Klimafolgenforschung (PIK)
- Umweltbundesamt (UBA)

The latest mobility statistics are available: (1) BMVI: Verkehr in Zahlen; (2) Mobilität in Deutschland (MiD) und (3) Deutsches Mobilitätspanel (MOP)
On the current discussion: Prätorius, G., „Corona-Rebound“ oder Schub für Klimaneutralität – Welche Entwicklung wird der Verkehr nehmen?; in: V+T, Verkehr und Technik, Heft 8/2021 (74. Jahrgang), Berlin, (https://doi.org/10.37307/j.1868-7911.2021.08.02)

Mobility Processes in Modern Societies	2,0	Seminar	german

Literature

International and national institutions and think tanks provide easily accessible documents and current studies for working on the topic clusters in the two seminars "Mobility Processes in Modern Societies" and "Governance of Transport Policy".
Examples are:

- OECD and International Transport Forum
- IEA International Energy Agency; World Energy Outlook.
- acatech – Deutsche Akademie der Technikwissenschaften; Mobilität und Klimaschutz
- Agora Verkehrswende; Klimaneutralität des Verkehrs.

Current mobility statistics are provided by: (1) BMVI: Verkehr in Zahlen; (2) Mobilität in Deutschland (MiD) und (3) Deutsches Mobilitätspanel (MOP)

On the current discussion: Prätorius, G., Der „nüchtern-harte“ und der „freundliche“ Weg zu einer neuen und klimaneutralen Mobilität; in: V+T, Verkehr und Technik, Heft 11/2021 (74. Jahrgang), Berlin (https://doi.org/10.37307/j.1868-7911.2021.11.02)

Title	Advanced Multivariate Data Analysis		
Number	2201000010	**Module version**	
Shorttext		**Language**	english
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 Dienstleistungsmanagement
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. David Woisetschläger
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 exam+ (60 min) or 1 oral exam+ (20 min) or 1 take-home exam or 1 portfolio		
Course achievement	1 portfolio or 1 presentation or 1 paper or 1 homework assignment		

Contents

- Regression Analysis
- Logistic and Non-Linear Regression
- Time Series Analysis
- Confirmatory Factor Analysis
- Experiments
- Structural Equation Models
- Multi-Level Analysis

Objective qualification

After completing this course, students will have advanced knowledge of multivariate data analysis methods in economics. They will be able to carry out and interpret multivariate data analyses using the open source software R.

Literature

Textbooks and further reading will be announced in the lectures
Supplementary literature (PDF documents, lecture notes for download)

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Related courses			
Rules for the choice of courses			
The coursework must be completed before the examination.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Advanced Multivariate Data Analysis	4,0	Lecture/Exercise	english
Literature			
• Lehrbücher und weiterführende Literatur werden in den Veranstaltungen bekannt gegeben • Ergänzende Literatur (PDF-Dokumente, Vorlesungsunterlagen zum Download			

Interface Management & Technology: Research	**12 ECTS**

Title	Scientific Working - Seminar		
Number	2299810	**Module version**	
Shorttext	WW-STD-81	**Language**	english german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	2	**Institution**	Department Wirtschafts-wissenschaften
Hours per Week / ECTS	9 / 12,0	**Module owner**	Studiendekan der Wirt-schaftswissenschaften
Workload (h)	360		
Class attendance (h)	126	**Self studying (h)**	234
Compulsory requirements			
Expected performance/ Type of examination	1 small term paper (4 CP) + 1 project paper (8 CP) or 1 small term paper (4 CP) + 1 large term paper (8 CP) or 3 small term papers (4 CP each)		
Course achievement			

Contents

The content of the seminar depends on the topic to be dealt with.

Objective qualification

The qualification objectives of the module are:
1. to learn how to work independently in an academic context and
2. to represent, defend and question scientific work professionally and thereby learn scientific discourse.

Literature

Depending on the chosen course and the specific task

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Related courses

Rules for the choice of courses

There are courses to be completed within the framework of 12 CP.

A maximum of 8 CP may be acquired per chair. Depending on the specifications of the chairs, knowledge of the respective orientation and/or specialization is required.

Compulsory attendance

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

Master-Seminar Economics 1	3,0	Seminar	german
Master-Seminar Management Control and Business Accounting	3,0	Seminar	german
Master-Seminar Decision Support	3,0	Seminar	english german
Literature			
themenabhängig			
	3,0	Seminar	german
Literature			
Wird in der Veranstaltung bekannt gegeben.			
Master-Seminar Services Management	3,0	Seminar	german
Literature			
Wird in der Veranstaltung bekannt gegeben.			
Master-Seminar Marketing	3,0	Seminar	german
Literature			
Die Literaturempfehlungen sind themenabhängig und werden in der Veranstaltung mitgeteilt.			
	3,0	Seminar	german
	3,0	Project	german
Master-Seminar Service Information Systems	3,0	Seminar	german
Research Project Information Management	3,0	Project	german
Master-Seminar Management and Organisation Science	3,0	Seminar	english german
Master-Seminar Data-Driven Enterprise	3,0	Seminar	german
Master-Seminar Decision Support	3,0	Seminar	english german
Literature			
themenabhängig			
Master-Seminar Business Ethics	3,0	Seminar	english german

Interface Management & Technology: Orientation	**3 ECTS**

Title	Orientation and Key Qualifications		
Number	2299800	**Module version**	
Shorttext	WW-STD-80	**Language**	german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	2	**Institution**	Department Wirtschafts-wissenschaften
Hours per Week / ECTS	/ 3,0	**Module owner**	Studiendekan der Wirt-schaftswissenschaften
Workload (h)	90 bis 240		
Class attendance (h)	112	**Self studying (h)**	128
Compulsory requirements			
Expected performance/ Type of examina-tion			
Course achievement	The examination modalities depend on the selected courses and can be found in the information on the respective lectures.		

Contents

Orientation:
Typical content - depending on students, current topics and lectures:
- Approaches of a technology management
- Innovation management in technology companies
- Communication and cooperation
- Technology push and Market pull
- Products and services
- Industries and business models

Key qualifications:
Various in the elective events of the overall program

Objective qualification

Orientation:
Students are sensitized to the interface between management and technology. They are familiar with problems in this field and can identify them on their own. They have a very basic but motivating knowledge of the subject area and have developed an idea about the direction of their further studies through their own research, presentation and discussion.

Key qualifications:
Area I: Overarching reference/Embedding of the field of study
Students are able to classify their field of study in social, historical, legal or career-oriented contexts (depending on the focus of the course). They are able to recognize, analyze and evaluate superordinate, subject-specific connections and their significance. Students gain an insight into the networking possibilities of the field of study and application references of their field of study in professional life.
Area II: Cultures of knowledge

The students
- get to know the theories and methods of other, non-subject-specific cultures of knowledge,
- learn to work and interact in an interdisciplinary manner with students from other fields of study,
- are able to discuss and evaluate current controversies from individual subject areas,
- are familiar with gender-related perspectives on various subject areas and the effects of gender differences,
- can deal intensively with application examples from other disciplines
Area III: Action-oriented offers
Students are enabled to implement theoretical knowledge in an action-oriented manner. They acquire procedural knowledge (knowledge about procedures and courses of action) as well as metacognitive knowledge (including knowledge about their own strengths and weaknesses). Depending on the focus of the course, students acquire the ability to:
- communicate knowledge and apply communication techniques,
- conduct discussions and negotiations effectively, reflect on themselves and evaluate themselves appropriately,
- work cooperatively in a team, manage conflicts,
- use information and communication media or
- express themselves in another language. The action-oriented courses enable students to use knowledge acquired in other areas more effectively, to work more easily and constructively with other people and thus to facilitate the acquisition and development of new knowledge. They acquire key qualifications that facilitate their entry into professional life and contribute to success in all professional situations.

Literature

Depending on the chosen topic of the presentation. Will be announced at the beginning of the course.

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Related courses

Rules for the choice of courses

Up to 8 credit points can be achieved in this module.

At least 3 CP must be acquired in this module, but a maximum of 8 CP, depending on the modules selected in the area of technology. Together, the two areas must add up to 28 CP.

Compulsory attendance

Name of the course	SWS	Eventtype	Language
	2,0	Series of lectures	german

Technology	**12 ECTS**

Title	Quality Assurance and Optimization		
Number	2411220	**Module version**	
Shorttext	ET-EMG-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 / 5,0	**Module owner**	Prof. Dr. Oleksandr Dobrovolskiy
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	Written exam (45 min); written exam (120 min) only in case of large numbers of participants		
Course achievement			

Contents

Introduction to the measurement process
Systematic and random measurement uncertainties/errors Noise and noise analysis
Determination of measurement uncertainty according to GUM
Fundamentals of applied statistics: distribution functions, estimation theory, hypothesis tests, error propagation
Equalisation calculation, regression analysis
Statistical design of experiments
Quality management

Objective qualification

After completing the module, students will have an overview of the fundamentals of quality management and process optimisation. Thanks to the practical knowledge acquired, students will be able to solve simple optimisation tasks using statistical design of experiments.

Literature

- E. Schrüfer: Elektrische Messtechnik (Hanser Verlag 2007), ISBN 978-3446409040
- W. Mendenhall: Statistics for Engineering and the Sciences (Prentice Hall 1991), ISBN 978-0023805523
- O. Hein: Statistische Verfahren der Ingenieurpraxis (B.I.-Wissenschaftsverlag 1978), ISBN 978-3411001194
- N. L. Johnson and F. C. Leone: Statistics and Experimental Design, Vol. 1+2 (John Wiley & Sons 1977), ISBN 978-0471017561 und 978-0471017578
- Hartmann, Lezki und Schäfer, Statistische Versuchsplanung und -auswertung in der Stoffwirtschaft, VEB Deutscher Verlag für Grundstoffindustrie, Leipzig 1974, im Bibliotheksbestand
- B. Pesch: Bestimmung der Messunsicherheit nach GUM (Books on Demand GmbH, 2004), ISBN 978-3833010392
- G. Linß: Qualitätsmanagement für Ingenieure (Hanser Fachbuchverlag Leipzig 2005), ISBN 978-3446228214

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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

- #E. Schrüfer: Elektrische Messtechnik (Hanser Verlag)# W. Mendenhall: Statistics for Engineering and the Sciences (Prentice Hall)
- O. Hein: Statistische Verfahren der Ingenieurpraxis (B.I.-Wissenschaftsverlag)
- N. L. Johnson and F. C. Leone: Statistics and Experimental Design, Vol. 1+2 (John Wiley & Sons)
- Hartmann, Lezki und Schäfer, Statistische Versuchsplanung und -auswertung in der Stoffwirtschaft, VEB Deutscher Verlag für Grundstoffindustrie, Leipzig
- B. Pesch: Bestimmung der Messunsicherheit nach GUM (Books on Demand GmbH)
- G. Linß: Qualitätsmanagement für Ingenieure (Fachbuchverlag Leipzig)

	1,0	Exercise	german

Literature

- #E. Schrüfer: Elektrische Messtechnik (Hanser Verlag)# W. Mendenhall: Statistics for Engineering and the Sciences (Prentice Hall)
- O. Hein: Statistische Verfahren der Ingenieurpraxis (B.I.-Wissenschaftsverlag)
- N. L. Johnson and F. C. Leone: Statistics and Experimental Design, Vol. 1+2 (John Wiley & Sons)
- Hartmann, Lezki und Schäfer, Statistische Versuchsplanung und -auswertung in der Stoffwirtschaft, VEB Deutscher Verlag für Grundstoffindustrie, Leipzig
- B. Pesch: Bestimmung der Messunsicherheit nach GUM (Books on Demand GmbH)
- G. Linß: Qualitätsmanagement für Ingenieure (Fachbuchverlag Leipzig)

Title	Automation Engineering		
Number	2539000020	**Module version**	
Shorttext		**Language**	english
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Jürgen Pannek
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	Control Theory or Fundamentals of Control Engineering		
Expected performance/ Type of examination	1 examination element: written exam+ (90 min) or oral exam+ (30 min)		
Course achievement	1 course achievement: Implementation and documentation of the project accompanying the lecture (on application, the result of the course achievement can account for up to 20% of the grade of the written exam+)		

Contents

Lecture/Tutorial:
- Aim of automation engineering
- Basics, tasks and methods of automation
- Coupling and hierarchies of systems
- Information and information management
- Control, modularization and standardization in automation
- Digitalization for industrial internet, industrial could and CPS
- Basics of knowledge management, industrial big data and decision support

Objective qualification

After having completed the module automation engineering, students are able to reproduce and explain extensive basic and methodological knowledge of automation systems as well as their components (process computer, actuators, sensors, HMI
). First of all, this contains that the students can explain the classification, the control and the coupling of technical processes exemplarily. They are also able to analyze information in technical processes and in signals, including signal detection and signal conversion, based on simple case examples. In addition, the students can describe basic computer structures in automation technology as well as the basics of the representation and processing of information in process computer systems in principle. Therefore, they can explain the mechanisms of process control for real-time capability and the task concept of operating systems exemplarily. They are also able to fundamentally categorize organizational, distribution and communication structures of automation systems based on simple case examples. In addition, students can reproduce basic knowledge concerning the means of description Petri Nets and are able to apply that means independently in order to model processes.

Literature

- Lunze, J.: Automatisierungstechnik. 5. Auflage. DeGruyter (2020)
- Plenk,V.: Grundlagen der Automatisierungstechnik kompakt, Springer (2019)
- Lai, C.: Intelligent Manufacturing, Springer (2022)

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

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

Title	Solar Cells		
Number	2413310	**Module version**	
Shorttext	ET-IHT-31	**Language**	english
Frequency of offer	every 2 years in the winter term	**Teaching unit**	Fakultät für Elektrotechnik, Informationstechnik, Physik
Module duration	1	**Institution**	Institut für Halbleitertechnik
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Stefanie Kroker
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	Oral exam (30 min) or *Klausur+*		
Course achievement			

Contents

The module proves an overview on photovoltaic generation of energy with its physical basics to fabrication of solarcells and application in modules and solar plants.

- Politics of renewable energies
- Physical basics of photovoltaic generation of electricity (sun radiation, absorption of radiation by semiconductors, p-n-junction, I-U-characteristics)
- Fabrication and structure of monocrystalline and multi-crystalline Solar cells
- Thin film solar cells, organic cells, dye cells
- Comparison of the different solar cell concepts
- Dimensioning of solar plants
- Applications

Objective qualification

The students can describe the principles of photovoltaic generation of electricity in solar cells. They can characterize solar cells to optimize their efficiency and configure simple photovoltaic devices using their characteristic parameters and geographic factors.

Literature

- Lecture slides and short script
- H.-G. Wagemann, A. Schmidt: Grundl. d. optoelektron. Halbleiterbauelemente; Teubner Stuttgart 1998 ISBN: 3-519-03240-6
- H.-G. Wagemann, H. Eschrich: Grundl. d. photovoltaischen Energieumwandlung; Teubner Stuttgart 1994 ISBN: 3-519-03218-X

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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 H.-G. Wagemann, H. Eschrich: Grundlagen der photovoltaischen Energiewandlung; Teubner Studienbücher, Stuttgart 1994			
	1,0	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

- 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

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.

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

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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

- 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, Springerverlag
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	Computational Methods in Bionics 1		
Number	2514600	**Module version**	
Shorttext	MB-ILR-60	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Thomas Vietor
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	Basic knowledge of differential calculus, basic understanding of biological and physical connections.		
Expected performance/ Type of examination	1 examination element: oral exam (30 min)		
Course achievement			

Contents

- Bionics as a science (definition, idea, goals, qualifications, structures)
- Social Systems (the biological foundation of social communities, system dynamics, agents, swarms)
- Biological principles of the evolution (history, terms, biological principle)
- Conventional methods of optimization (indirect methods, direct methods)
- Bionic methods of optimization (evolutionary algorithms, examples: evolution strategies, example: genetic algorithms, evolutionary programming, simulated annealing, particle swarm optimization)
- Neuronal networks (biological principle of neuronal networks, pattern recognition, regulation)

Objective qualification

The students are capable of: - describing bionic as an engineering science method - naming and describing the principles of biological mechanisms - applying descriptions of social systems and behavior towards economic-technical simulation systems - systemizing methods of optimization in the form of indirect, direct and bionic methods based on examples - describing and explaining the bionic methods of optimization trough the biological example, in an information technological manner - name and explain the structure and usage of neuronal networks - applying the studied principles of the approaches of bionics towards computational methods and being able to point them out in examples

Literature

- Nachtigall, W.: Bionik, Springer-Verlag, Berlin (1998)
- Beyer, H.-G.: The Theory of Evolution Strategies, Springer-Verlag, Berlin, Heidelberg (2001)
- Forrester, J. R.: Urban Dynamics, Pegasus Communications, Waltham (1969)
- Rechenberg, I.: Evolutionsstrategie '94, Frommann-Holzboog-Verlag, Stuttgart (1994)
- Rojas, R.: Theorie der neuronalen Netze, Springer-Verlag Berlin (1996)
- Schwefel, H.-P.: Evolution and Optimum Seeking, Verlag Wiley & Sons, New York (1995)

Remark

The lecture will be read in English if necessary.

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

Title	Advanced methods to product development		
Number	2516040	**Module version**	
Shorttext	MB-IK-04	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Thomas Vietor
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	Basic understanding of the product development process and the product creation process, basic knowledge of the common methods for product development, (the participation on the modules #Grundlagen der Produktentwicklung und Konstruktion# is advised)		
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)		
Course achievement			

Contents

- Function- and design principles for finding solutions
- Bionics, the theory of inventive problem solving (TRIZ)
- Methods for systematic evaluation and selection of solutions (e.g. utility analysis)
- Methods of quality-oriented design (e.g. fault tree analysis, FMEA)
- Methodical reduction of disruptive effects
- Processing of complaints
- Methods for identifying and reducing costs during product development

Objective qualification

The students are able to:

- apply general and specific methods and working methods to different problems in product development
- to name in-depth knowledge of variation and analogy and to apply it using the example of selected methods
- to name and apply in-depth knowledge for the evaluation and selection of solutions and quality and safety-conscious design

Literature

- Altschuller, G. S.: Erfinden - Wege zur Lösung technischer Probleme. 2. Auflage, Verlag Technik, 1998
- Orloff, M. A.: Grundlagen der klassischen TRIZ - Ein praktisches Lehrbuch des erfinderischen Denkens für Ingenieure. Springer-Verlag, 2002
- Breiing, A., Knosala, R.: Bewerten technischer Systeme - theoretische und methodische Grundlagen bewertungstechnischer Entscheidungshilfen. Springer-Verlag, 1997
- Pahl, G., Beitz, W., Feldhusen, J., Grote. K.-H.: Pahl/Beitz Konstruktionslehre - Grundlagen erfolgreicher Produktentwicklung, Methoden und Anwendung. 7. Auflage, Springer-Verlag, 2007
- Nachtigall, W.: Bionik als Wissenschaft: Erkennen - Abstrahieren - Umsetzen. Springer-Verlag, 2010
- Nachtigall, W.: Biologisches Design - Systematischer Katalog für Bionisches Gestalten. Springer-Verlag, 2005

- Ehrlenspiel, K., Kiewert, A., Lindemann, U.: Kostengünstig entwickeln und Konstruieren - Kostenmanagement bei der integrierten Produktentwicklung. Springer-Verlag, 2007

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Related courses			
Rules for the choice of courses			
Lecture and tutorial must be attended.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	1,0	Exercise	german

Title	Advanced Methods to Product Development and Laboratory		
Number	2516280	**Module version**	
Shorttext	MB-IK-28	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 7,0	**Module owner**	Prof. Dr. Thomas Vietor
Workload (h)	210		
Class attendance (h)	56	**Self studying (h)**	154
Compulsory requirements			
Recommended requirements	Basic understanding of the product development process and the product creation process, basic knowledge of the common methods for product development, (the participation on the modules #Grundlagen der Produktentwicklung und Konstruktion# is advised)		
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)		
Course achievement	1 course achivement: laboratory report and presentation		

Contents

- Function- and design principles for finding solutions
- Bionics, the theory of inventive problem solving (TRIZ)
- Methods for systematic evaluation and selection of solutions (e.g. utility analysis)
- Methods of quality-oriented design (e.g. fault tree analysis, FMEA)
- Methodical reduction of disruptive effects
- Processing of complaints
- Methods for identifying and reducing costs during product development

Objective qualification

The students are able to:

- apply general and specific methods and working methods to different problems in product development
- to name in-depth knowledge of variation and analogy and to apply it using the example of selected methods
- to name and apply in-depth knowledge for the evaluation and selection of solutions and for quality and safety-conscious design
- to practically apply in-depth methods of system development using the example of the structure and function of an e-cargo bike.
- to map requirements, functions, and system structure with the help of diagrams of the modelling techniques UML and SysML.

Literature

- Altschuller, G. S.: Erfinden - Wege zur Lösung technischer Probleme. 2. Auflage, Verlag Technik, 1998
- Orloff, M. A.: Grundlagen der klassischen TRIZ - Ein praktisches Lehrbuch des erfinderischen Denkens für Ingenieure. Springer-Verlag, 2002
- Breiing, A., Knosala, R.: Bewerten technischer Systeme - theoretische und methodische Grundlagen bewertungstechnischer Entscheidungshilfen. Springer-Verlag, 1997
- Pahl, G., Beitz, W., Feldhusen, J., Grote. K.-H.: Pahl/Beitz Konstruktionslehre - Grundlagen erfolgreicher Produktentwicklung, Methoden und Anwendung. 7. Auflage, Springer-Verlag, 2007

- Nachtigall, W.: Bionik als Wissenschaft: Erkennen - Abstrahieren - Umsetzen. Springer-Verlag, 2010
- Nachtigall, W.: Biologisches Design - Systematischer Katalog für Bionisches Gestalten. Springer-Verlag, 2005
- Ehrlenspiel, K., Kiewert, A., Lindemann, U.: Kostengünstig entwickeln und Konstruieren - Kostenmanagement bei der integrierten Produktentwicklung. Springer-Verlag, 2007

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Related courses			
Rules for the choice of courses			
Lecture, excercise and laboratory have to be attended			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	1,0	Exercise	german
	1,0	Laboratory	german

Title	Airline-Operation		
Number	2518140	**Module version**	
Shorttext	MB-PFI-14	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinen-bau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Jens Friedrichs
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)		
Course achievement			

Contents

- Air-Transport System and Business-Models
- Regulations and Airworthiness (Germany, EU, US)
- Airline network # Technical aspects
- Airline network # Logistical aspects
- Components, QEC & LRU (Cost models and reliability, maintenance and stock planning)

Objective qualification

Students can apply technical and business management knowledge for the selection and use of different engine models. They know the typical operating models of airlines and can set up and analyse typical real operating models. The essential international agreements and air traffic laws are understood and operating models can be assessed under aviation law. The requirements for maintenance models for engines and equipment can be applied in the sense of evaluating and planning maintenance strategies and spare parts stocking. Students can carry out condition-based operational monitoring using modern tools. Students can use the correlations and sensitivities of aircraft performance and derating for mission planning to analyse and evaluate new missions and equipment.

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
	1,0	Exercise	german

Title	Renewable Energy Technologies		
Number	2520170	**Module version**	
Shorttext	MB-WuB-17	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Daniel Schröder
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	1 Examination element: Written exam (120 min)		
Course achievement			

Contents

Lecture:
- Overview of forms and extent of renewable energies
- Geothermal energy Biomass and fuel cells Biogas
- Thermal solar energy for space heating and hot water production
- Solar heat power stations
- Photovoltaics
- Windpower plants
- Water-power plants

Exercise:
- Calculation of examples

Objective qualification

The students can name the basic technologies for renewable energy conversion and storage and are able to draft their combination to systems. They are able to calculate the theoretical efficiencies for the most significant technologies and thus are able to compare them. They know the typical efficiencies of various systems and on this basis they are able to evaluate present systems. Further, they know the major characteristic advantages and disadvantages of the technologies and are able to develop measures for improvement on this basis. Besides, they are able to design simple systems. They can analyze the integration of renewable energy technologies into the electrical energy supply system and are able to evaluate the systems in the context of current and future challenges.

Literature

- Winter, Nitsch: Wasserstoff als Energieträger, Springer, ISBN: 3-540-15865-0
- Bührke, Wengenmayer: Erneuerbare Energie, Wiley-VCH 2007, ISBN-10: 3-527-40727-8
- Stoy: Wunschenergie Sonne, ISBN: 3-87200-611-8;
- Kaltschmitt, Hartmann: Energie aus Biomasse, Springer, ISBN: 3-540-64853-4
- Insti, W. et al.: Wasserstoff, die Energie für alle Zeiten, Udo Pfriemer Verlag 1980, ISBN: 3-7906-0092-X

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

Title	Industrial Robots		
Number	2522120	**Module version**	
Shorttext	MB-IWF-12	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Klaus Dröder
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	Basic knowledge of engineering mechanics, vector and matrix calculus, differential calculus and control engineering		
Expected performance/ Type of examination	1 examination element: written exam (120 min) or oral exam (30 min)		
Course achievement			

Contents

- Introduction: History, groups of robots, fields of apply
- Structure-development: degrees of freedom, joints, serial and parallel structures, structure of a robot
- Programming: Types of programming, languages of programming (especially KRL)
- Kinematic: Elementary-transformation, kinematic robot-model, types of calculation, singularities
- Dynamic and bearing-control: dynamic robot model, calculation of forces and moments, types of bearing-control
- Control: Creation of movement, structure, sensor integration

Objective qualification

Students
- have the ability to differentiate between serial and parallel structures and to divide the robot into main and secondary axes.
- are able to analyze workspaces and designs and will be able to evaluate them with regard to application criteria.
- will be able to explain components of the robot.
- are able to explain and calculate kinematic and dynamic models of different robots.
- are able to name the control approaches and device-related structures required for the control system, and to apply textual and graphic-interactive programming forms.

Literature

- Lenarcic, J.; Parenti V.: Advances in Robot Kinematics 2018. Springer, Berlin, 2018
- Appleton, E.; Williams, D. J.: Industrieroboter: Anwendungen. VCH: Weinheim, New York, Basel, Cambridge, 1991
- Knoll, A.; Christaller, T.: Robotik. Fischer, Frankfurt, November 2003
- Siciliano, B.; Khatib, O.: Springer Handbook of Robotics, Springer Verlag, Berlin, 2008
- Volmer, J.: Industrieroboter - Funktion und Gestaltung. Verl. Technik: Berlin, 1992
- Weber, W.: Industrieroboter. Carl Hanser Verlag: München, Wien, 2019

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Related courses			
Rules for the choice of courses			
Lecture and exercise must be attended.			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	1,0	Exercise	german

Title	Production Technology for Automotive Engineering		
Number	2522330	**Module version**	
Shorttext	MB-IWF-33	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinen-bau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Klaus Dröder
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examina-tion	1 Examination element: written exam (120 min) or oral exam (30 min)		
Course achievement			

Contents

- Basics of the composite technology (design, manufacturing)
- Forming manufacturing processes (compression and tension forming)
- Machining and ablating processes (especially of Al and St)
- Joining methods (welding, soldering, bonding)
- Heat treatment of Al and St
- Coating process (corrosion protection)
- Basics of automation and assembly technology

Objective qualification

The Students

- will be able to explain the technical processes and common procedures used in the automotive industry
- can derive relevant content from manufacturing technology, joining and bonding technology, coating technology and multi-material lightweight design as well as the automation and assembly technology as a result of the examples taken from automotive manufacturing
- get to know the complete technical production aspects of modern automotive engineering by dealing additionally with facilities and their components
- are able to select appropriate manufacturing processes and evaluate process parameters depending on the respective application at the end of the course

Literature

Lecture notes, further information will be announced in the lecture.

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

Title	Production Technologies for Electromobility		
Number	2522540	**Module version**	
Shorttext	MB-IWF-54	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Fakultät für Maschinen-bau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Klaus Dröder
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	Students know the fundamental relationships between electrical circuits		
Expected performance/ Type of examination	1 Examination element: Written exam (120 min)		
Course achievement			

Contents

- Introduction to electric mobility
- Forms of electric mobility
- Overview of production technology
- Principles of production technology
- Focus of research and development of production technology
- Production of vehicles
- Comparison of the electric power unit and the combustion engine
- Types of electric vehicles
- Production of electric cars (Focus lightweight construction / power unit)
- Demands and challenges in the production of battery systems
- Functionalities and types of battery cells
- Components and hierarchy of high volt systems
- Production of battery cells Production of battery modules and #systems
- Production of electric engine
- Focus on assembly systems for HV components
- Safety and Protection
- Lightweight construction for the casing of a battery system
- Design of a battery system and associated production system

Objective qualification

Students are able to
#

- differentiate the specific components of an electric car from the components of a conventional car #
- deduce the effects of new components on the supply chains of the OEM and the automotive suppliers #
- plan basic production processes for the electric drivetrain taken into consideration the challenges in production technologies for electric vehicles #
  identify potentials for optimisation of assembly and disassembly of traction batteries #
- assign tasks in assembly according tot he qualification of the employees #
- name new production technologies for lightweight construction an the electric power unit, assign them to the correct position in the process chain, identify safety relevant tasks and take risk-reducing measures #

- work in multi-disciplinary teams

Literature

- Braess, Hans-Hermann; Seiffert, Ulrich (Hg.) (2013): Vieweg Handbuch Kraftfahrzeugtechnik. 7., aktual. Aufl. 2013. Wiesbaden, s.l: Springer Fachmedien Wiesbaden Dyckhoff,
- Harald; Spengler, Thomas S. (2010): Produktionswirtschaft. Eine Einführung. 3., überarb. und erw. Aufl. Berlin: Springer Friedrich,
- Horst E. (Hg.) (2013): Leichtbau in der Fahrzeugtechnik. Wiesbaden, s.l: Springer Fachmedien Wiesbaden Kampker,
- Achim; Vallée, Dirk; Schnettler, Armin (2013): Elektromobilität. Grundlagen einer Zukunftstechnologie. Berlin, Heidelberg: Springer Klein,
- Bernd (2013): Leichtbau-Konstruktion. Berechnungsgrundlagen und Gestaltung. 10., überarb. u. erw. Aufl. 2013. Wiesbaden, s.l: Springer Fachmedien Wiesbaden.
- Korthauer, Reiner (Hg.) (2013): Handbuch Lithium-Ionen-Batterien. Berlin, Heidelberg, s.l: Springer Berlin Heidelberg.
- Ponn, Josef; Lindemann, Udo (2011): Konzeptentwicklung und Gestaltung technischer Produkte. Systematisch von Anforderungen zu Konzepten und Gestaltlösungen. 2. Aufl. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg (VDI-Buch).
- Siebenpfeiffer, Wolfgang (Hg.) (2013): Energieeffiziente Antriebstechnologien. Hybridisierung - Downsizing - Software und IT. Dordrecht: Springer Wallentowitz,
- Henning; Freialdenhoven, Arndt (2011): Strategien zur Elektrifizierung des Antriebsstranges. Technologien, Märkte und Implikationen. 2., überarbeitete Auflage. Wiesbaden: Vieweg+Teubner Verlag / Springer Fachmedien Wiesbaden GmbH Wiesbaden

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Related courses

Rules for the choice of courses

Compulsory attendance

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

Title	Industrial Robots with Laboratory		
Number	2522560	**Module version**	
Shorttext	MB-IWF-56	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 7,0	**Module owner**	Prof. Dr. Klaus Dröder
Workload (h)	210		
Class attendance (h)	56	**Self studying (h)**	154
Compulsory requirements			
Recommended requirements	Requirements: Basic knowledge of engineering mechanics, vector and matrix calculus, differential calculus and control engineering		
Expected performance/ Type of examination	1 examination element: written exam (120 min) or oral exam (30 min)		
Course achievement	1 course achivement: protocol of the laboratory experiments		

Contents

- Introduction: History, groups of robots, fields of apply
- Structure-development: degrees of freedom, joints, serial and parallel structures, structure of a robot
- Programming: Types of programming, languages of programming (especially KRL)
- Kinematic: Elementary-transformation, kinematic robot-model, types of calculation, singularities
- Dynamic and bearing-control: dynamic robot model, calculation of forces and moments, types of bearing-control
- Control: Creation of movement, structure, sensor integration

Objective qualification

Students...

- have the ability to differentiate between serial and parallel structures and to divide the robot into main and secondary axes.
- are able to analyze workspaces and designs and will be able to evaluate them with regard to application criteria.
- will be able to explain components of the robot.
- are able to explain and calculate kinematic and dynamic models of different robots.
- are able to name the control approaches and device-related structures required for the control system, and to apply textual and graphic-interactive programming forms.
- are able to identify structure-specific problems and develop solution strategies.
- can place themselves in a group, contribute to the solution and present the results.

Literature

- Lenarcic, J.; Parenti V.: Advances in Robot Kinematics 2018. Springer, Berlin, 2018
- Appleton, E.; Williams, D. J.: Industrieroboter: Anwendungen. VCH: Weinheim, New York, Basel, Cambridge, 1991
- Knoll, A.; Christaller, T.: Robotik. Fischer, Frankfurt, November 2003
- Siciliano, B.; Khatib, O.: Springer Handbook of Robotics, Springer Verlag, Berlin, 2008
- Volmer, J.: Industrieroboter - Funktion und Gestaltung. Verl. Technik: Berlin, 1992
- Weber, W.: Industrieroboter. Carl Hanser Verlag: München, Wien, 2019

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

Title	Alternative, electro and hybrid drives		
Number	2534060	**Module version**	
Shorttext	MB-FZT-06	**Language**	english
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Roman Henze
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	1 Examination element: written exam (90 min)		
Course achievement			

Contents

- Historical overview of alternative powertrains
- Legal and political frameworks for powertrain development
- Primary energy sources and fuels
- Hybrid and electric drivetrains
- Components of hybrid and electric drivetrains
- Fuel cell electric vehicles
- Comparison of drivetrain concepts
- Outlook towards future powertrain development trends

Objective qualification

After completion of the module, students are able to evaluate alternative drive concepts as well as their design and conception. Students are able to discuss the historical, legal, economic and ecological boundary conditions for alternative, electric and hybrid drives on the basis of a comprehensive foundation. The students are able to assess different measures for improving efficiency and thus reducing fuel consumption on the basis of the elements of energy consumption as well as their knowledge about the influences of powertrain and vehicle parameters. The students can enumerate exemplary field conditions for the use of alternative and electrified vehicles and derive the resulting requirements for the powertrain. The students are independently able to classify electric and hybrid vehicles and their components with regard to their structure and functions, to integrate them into new vehicle concepts and to compare them on the basis of efficiency, performance, cost and installation space criteria. In addition, the students will be able to describe the transmissions integrated in HEV and BEV, their specifics and requirements as well as the requirements for chassis and brakes in vehicles with electrified drives using examples. Furthermore, the students are able to classify and evaluate electric motors, power electronics, energy sources and storage systems based on appropriate criteria.

Literature

- TSCHÖKE, H.: Die Elektrifizierung des Antriebsstrangs -Grundlagen -vom Mikro-Hybrid zum vollelektrischen Antrieb, Springer Verlag, 2019
- NAUNHEIMER, H.: Fahrzeuggetriebe #Grundlagen, Auswahl, Auslegung und Konstruktion, Springer Verlag, 2019
- HOFMANN, P.: Hybridfahrzeuge, Springer Verlag, 2014
- KAMPKER, A.: Elektromobilität, Springer Verlag, 2018

- KREMSER, A.: Elektrische Maschinen und Antriebe #Grundlagen, Motoren und Anwendungen, Springer Verlag, 2017
- KLELL, M.: Wasserstoff in der Fahrzeugtechnik #Erzeugung, Speicherung, Anwendung, Springer Verlag, 2018
- REIF, K.: Basiswissen Hybridantriebe und alternative Kraftstoffe, Springer Verlag, 2018
- AVL: Engine and Environment, Proceedings, AVL, 2018
- ZACH, F.: Leistungselektronik, Springer Verlag Wien, 2010
- GEHRINGER, B.: 39. Internationales Wiener Motorensymposium, Proceedings, VDI Fortschritt-Berichte, 2018
- BINDER, A.: Elektrische Maschinen und Antriebe #Grundlagen, Betriebsverhalten, Springer Verlag, 2017
- NELSON, V.: IntroductiontoRenewableEnergy, CRC Press, 2015
- DENTON, T.: ElectricandHybrid Vehicles, CRC Press, 2016
- STAN, C.: Alternative Antriebe für Automobile: Hybridsysteme, Brennstoffzellen, alternative Energieträger, Springer Verlag, 2012
- VOGEL, M.: Kompendium Li-Ionen Batterien. Grundlagen, Bewertungskriterien, Gesetze und Normen, VDE Verband der Elektrotechnik, 2015
- LIEBL, J.: Energiemanagement im Kraftfahrzeug, Springer Verlag, 2014 ITS
- NIDERSACHSEN: Hybrid and ElectricVehicles, Proceedings, ITS, 2018
- BABIEL, G.: Bordnetze und Powermanagement, Springer Verlag, 2019

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Alternative, Electro and Hybrid Drives	2,0	Lecture	german
	1,0	Exercise	german

Title	Reliability Engineering		
Number	2539100	**Module version**	
Shorttext	MB-VuA-10	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Sabine Langer
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	No special qualifications are required for the participation in this module.		
Expected performance/ Type of examination	1 Examination element: written exam, 90 minutes or oral exam, 30 minutes		
Course achievement			

Contents

- Reliability terminology
- concepts and rules of probability theory
- statistical reliability measures
- lifetime and state distribution functions
- system reliability
- Markov chains
- maintainability

Objective qualification

After having completed the module, students will be able to derive system reliability models based on common means of description, methods and tools as well as making reliability design decisions based on those models. The students can formulate and name elementary definitions of reliability, probability theory, important distribution functions of component states and life times as well as statistical measures used in system reliability. Furthermore, students are able to calculate probabilities for determining the reliability of single/multi-component systems. On the basis of case studies, they can evaluate the effects of reliability assessment, fault-tolerant structures as well as reserve and maintenance strategies. Moreover, they can apply Markov chains to incorporate the aspects of maintenance into these computations. The students understand the different concepts of maintainability on the basis of selected examples.

Literature

- Bertsche, Bernd; Lechner, Gisbert; Zuverlässigkeit im Fahrzeug- und Maschinenbau - Ermittlung von Bauteil- und System-Zuverlässigkeiten Springer-Verlag, 2004
- Meyna, A.; Pauli, B.; Taschenbuch der Zuverlässigkeits-und Sicherheitstechnik, Hanser, 2003
- Ericson, Clifton A.; Hazard Analysis Techniques for System Safety, Wiley & Sons, 2005

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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 mit ca. 120 Seiten Ergänzende Literatur wird zu Beginn der Vorlesung vorgeschlagen.			
	1,0	Exercise	german

Title	Traffic Control Engineering		
Number	2539400	**Module version**	
Shorttext	MB-VuA-40	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Fakultät für Maschinenbau
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Karsten Lemmer
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 examination element: written exam (120 min)		
Course achievement	written report on practical exercices		

Contents

- traffic engineering;
- terminology and characteristics of traffic elements;
- classification of traffic;
- traffic objects, vehicles, infrastructure, production and distribution concepts;
- operation and network management, traffic flow management, traffic organization;
- traffic physics;
- distribution of traffic, single vehicle control and information management.

Objective qualification

Students are able to analyse the functions, structures and technologies of traffic control systems as well as the physical, technological and operational fundamentals of land vehicles and infrastructure and to evaluate these using technical examples from the operations of road and railway transport. In doing so, they apply the technical terminology and the basics of transport technology as well as specific definitions and model concepts of road and rail transport and use them when working on technical examples. Students have the capacity of transferring what they have learned to the practical and operational conditions as they are presented in practical exercises at vehicle manufacturers and infrastructure facilities as well as operators of road and rail transport. They are able to explain traffic control concepts related to those practical examples. Students analyse the technical possibilities of influencing individual vehicle movement, traffic flows and traffic streams in mono- and multimodal networks and derive suitable solutions on the basis of case studies. Building on that, they discuss dynamic model concepts based on microscopic physical models up to aggregated flow models using practical examples and are able to apply those methods, means of description and tools to reproduce and analyse behaviour patterns with the aid of simulation models.

Literature

Remark

The lecture traffic control engineering provides a systematic overview of the basics for understanding of transport systems and their functions and structures as well as their technical realization in ground transportation. It is supplemented by practical field trips to vehicle manufacturers, infrastructure facilities and operators of road and rail transport.

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

Title	Relational database systems 2		
Number	4214570	**Module version**	V2
Shorttext	INF-IS-49	**Language**	german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Informations-systeme
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Wolf-Tilo Balke
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examina-tion	1 graded work: Written exam (90 minutes) or oral exam (30 minutes) or Take-Home-Exam.		
Course achievement	1 Coursework: 50% of the exercises must be passed		

Contents

- Advanced ER modelling
- Object-oriented modelling
- Implementation, physical organisation, index structures
- Sequence control of parallel transactions, commit and lock protocols
- DB recovery and associated algorithms
- Triggers and active databases
- Normal form theory, functional dependencies

Objective qualification

After completing this module, students will have in-depth knowledge in the field of relational databases.

Literature

- Ramez Elmasr, Shamkant Navathe: Fundamentals of Database Systems. Addison Wesley. ISBN 10: 032141506X.

- Avi Silberschatz, Henry F. Korth, S. Sudarshan: Database Systems Concepts. McGraw Hill. ISBN 10: 0072958863.

- Hector Garcia-Molina, Jeffrey Ullman, Jennifer Widom: Database Systems. Prentice Hall. ISBN 10: 0130319953.

- Alfons Kemper, André Eickler: Datenbanksysteme. Oldenbourg Wissenschaftsverlag. ISBN 10: 3486576909.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Relational database systems 2	2,0	Lecture	german
Literature			
wird in der Vorlesung bekanntgegeben			
Relational database systems 2	1,0	Exercise	german

Title	Multimedia Databases		
Number	4214610	**Module version**	V2
Shorttext	INF-IS-52	**Language**	german
Frequency of offer	irregular	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Informations-systeme
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Wolf-Tilo Balke
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examina-tion	1 graded work: Written exam, 90 minutes, or oral exam, approx. 30 minutes, or Take-Home-Exam.		
Course achievement	1 non-graded work: 50% of the exercises must be passed		

Contents

- General structure of multimedia databases
- Advanced document types, multimedia documents
- Image-content search, low-level and high-level features
- High-dimensional indexing, inverted files, R-, M- and X-trees
- Search in audio files, acoustic features, e.g. pitch recognition
- Music retrieval, Hidden Markov Models, Query by Humming, etc.
- Video retrieval, segmentation and shot detection
- Video similarity, video signatures, abstracting and summaries

Objective qualification

Upon completion of this module, students will have basic knowledge in the field of multimedia databases.

Literature

- Ingo Schmitt: Ähnlichkeitssuche in
Multimedia-Datenbanken. Oldenbourg Wissenschaftsverlag, 2005.

- Vittorio Castelli, Lawrence D. Bergman: Image Databases. Wiley & Sons, 2002.

- Ralf Steinmetz: Multimedia-Technologie: Grundlagen, Komponenten und Systeme. Springer Verlag, 1999.

- Setrag Khoshafian, Brad Baker: Multimedia and Imaging Databases. Morgan Kaufmann, 1996.

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

Title	Representation and Analysis of Medical Data		
Number	4217680	**Module version**	V2
Shorttext	INF-MI-68	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Peter L. Reichertz Institut für Medizinische Informatik
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Tim Kacprowski
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Recommended requirements	Before participating in ‘Representation and Analysis of Medical Data’, students should have completed the module ‘Introduction to Medical Informatics’.		
Expected performance/ Type of examination	1 graded work: Written exam (90 minutes) or oral exam (30 minutes) or portfolio or Take-Home-Exam.		
Course achievement			

Contents

- Introduction
- Basic concepts of medical documentation and filing systems
- Important medical filing systems
- Typical medical documentation
- Benefits and use of medical documentation systems
- Planning medical documentation and filing systems
- Documentation in hospital information systems
- Documentation in clinical trials

Objective qualification

Students have knowledge of common documentation and classification systems in medicine. They are familiar with classification and indexing methods and can apply them, especially in diagnoses. They are able to analyse typical medical documentation and classify it in current health policy discussions. They should be able to construct medical documentation and classification systems.

Literature

- Leiner, F; Gaus, W et al (2012): Medizinische Dokumentation, 6. Auflage. Stuttgart: Schattauer Verlag

- IMIA Yearbook of Medical Informatics [erscheint jährlich]

- Dugas, Martin (2017). Medizininformatik. Berlin: Springer Vieweg.

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

Title	Software Quality 2		
Number	4220380	**Module version**	V2
Shorttext	INF-SSE-38	**Language**	german
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Softwaretechnik und Fahrzeuginformatik
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Ina Schaefer
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Recommended requirements	Students must have a basic understanding of the communication mechanisms of distributed systems, the essential diagram types of UML and, above all, an understanding of discrete mathematics (logic, algebra and algebraic specification). Students are expected to actively participate in the lecture by, for example, using their own laptops during lecture/exercise time to develop and implement their own solutions to problems.		
Expected performance/ Type of examination	1 graded work: Written exam (90 minutes) or oral exam (30 minutes) or Take-Home-Exam.		
Course achievement			

Contents

- Fundamental principles of modelling
- Theory of distributed systems
- Simulation of asynchronous communication
- Semantics of models

Objective qualification

After completing the module, students will have gained an in-depth insight into fundamental techniques and methods for developing complex software systems. They will learn formalisms and concepts that enable them to model and analyse individual aspects of complex systems in the form of suitable theories and calculations. These model the interaction of communicating systems and allow for composition and refinement. Building on this, students learn how semantics for modelling languages can be defined and what statements can be derived from them.

Literature

Literature is derived from our own research work.

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Online-lecture	german
	2,0	Online-exercise	german

Title	Managing Industrial Software Developments		
Number	4220420	**Module version**	V2
Shorttext	INF-SSE-41	**Language**	english
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Softwaretechnik und Fahrzeuginformatik
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Ina Schaefer
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examination	graded work: oral exam, 30 minutes, or written exam, 90 minutes or Take-Home-Exam.		
Course achievement			

Contents

- Industrial Information Management
- Product Software
- General conditions for SW production in a company - tasks of project management
- SW development projects
- Process models
- Planning and execution of development projects
- Software quality and assessment
- Company knowledge and maturity-models
- Example application from the area of parallel computer software

Objective qualification

After completing the module, students have an overview of professional industrial management of development projects using software development as an example. They have basic knowledge of project-, requirements-, quality-, and configuration- management, as well as the organizational interaction of large industrial structures. They know the most important process-, quality- and maturity- models and can apply them. Building on the fundamentals, the application in everyday industrial life is demonstrated using illustrative examples.

Literature

- Hindel, B.; Hörmann, K.; Müller, M.; Schmied, J.: „Basiswissen Software-Projektmanagement“; dpunkt Verlag, Heidelberg (2004)

- Messnarz, R.; Tully, C.: „Better Software Practice for Business Benefit – Principles and Experience“; IEEE Computer Society, Los Alamitos (1999)

- Wallmüller, E.: „Software-Qualitätsmanagement in der Praxis“; Hanser Verlag; München u.a. (2001)

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	3,0	Lecture/Exercise	english

Title	Automotive Software Engineering		
Number	4220450	**Module version**	V2
Shorttext	INF-SSE-45	**Language**	english
Frequency of offer	only in the winter term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Softwaretechnik und Fahrzeuginformatik
Hours per Week / ECTS	4 / 5,0	**Module owner**	Prof. Dr. Ina Schaefer
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	graded work: portfolio or Take-Home-Exam		
Course achievement	non-graded work: all practical tasks must have been successfully completed.		

Contents

- Fundamentals and boundary conditions for software development in the automotive sector
- Modeling techniques
- Development processes and methodology
- quality assurance
- Tools and tool sets
- case studies

Objective qualification

After completing this module, students will know the essential fundamentals and suitable methods and tools for software development in the automotive sector. The students can apply basic software development methods of embedded systems and the techniques for complexity and quality management.

Literature

- J. Schäuffele, Th. Zurawka: Automotive Software Engineering. Vieweg Verlag 2003.
- O. Kindel, M.Friedrich: Softwareentwicklung mit AUTOSAR. Grundlagen, Engineering, Management für die Praxis. dpunkt-Verlag 2009.
- P. Liggesmeyer, D. Rombach (Hrsg.): Software Engineering eingebetteter Systeme. Elsevier 2005.
- W. Zimmermann, R. Schmidgall: Bussysteme in der Fahrzeugtechnik - Protokolle, Standards und Softwarearchitektur. 4. Auflage. Vieweg 2011.

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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

- O. Kindel, M. Friedrich: Softwareentwicklung mit AUTOSAR. Grundlagen, Engineering, Management für die Praxis, dpunkt.verlag, 2009

- P. Liggesmeyer, D. Rombach (Hrsg.): Software Engineering eingebetteter Systeme, Elsevier, 2005.

- Werner Zimmermann Ralf Schmidgall, Bussysteme in der Fahrzeugtechnik Protokolle, Standards und Softwarearchitektur, 4. Auflage, Vieweg, 2011.

- Schäuffele, Zurawka: Automotive Software Engineering, Vieweg Verlag 2003.

	2,0	Exercise	german

Literature

- O. Kindel, M. Friedrich: Softwareentwicklung mit AUTOSAR. Grundlagen, Engineering, Management für die Praxis, dpunkt.verlag, 2009
- P. Liggesmeyer, D. Rombach (Hrsg.): Software Engineering eingebetteter Systeme, Elsevier, 2005.
- Werner Zimmermann Ralf Schmidgall, Bussysteme in der Fahrzeugtechnik Protokolle, Standards und Softwarearchitektur, 4. Auflage, Vieweg, 2011.
- Schäuffele, Zurawka: Automotive Software Engineering, Vieweg Verlag 2003.

Title	Local Public Transport - Planning of Infrastructure		
Number	4306410	**Module version**	
Shorttext	inaktiv	**Language**	german
Frequency of offer		**Teaching unit**	Fakultät Architektur, Bauingenieurwesen und Umweltwissenschaften
Module duration		**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			
-Reinhardt: Öffentlicher Personennahverkehr -Pachl: Systemtechnik des Schienenverkehrs -Naumann: Leit- und Sicherungstechnik im Bahnbetrieb			

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

Title	Railway Operation		
Number	4310610	**Module version**	
Shorttext	BAU-STD4-6	**Language**	german
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Eisenbahnwesen und Verkehrssicherung
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Jörn Pachl
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (60 Min.) or oral exam (approx. 30 Min.)		
Course achievement	Termpaper (approx. 30 h workload)		

Contents

- Basic operating terms and definitions
- Capacity research (capacity evaluation, analytical methods, simulation)
- Timetabling (traffic diagrams, time elements, running time calculation, planning of conflict-free train paths, cyclic timetables)
- Train path management (market structure, train path pricing, facility prices, station stop prices, train path requesting and assigning procedure)
- Traffic control (employees in traffic control, train movements in normal and degraded mode operations, shunting)
- Marshalling yards (purpose and structure of a marshalling yard, sorting procedure, hump dynamics, retarders)

Objective qualification

The students get profound knowledge on planning, management and control of train traffic. As employees of railway infrastructure companies or consulting firms, they are able to evaluate the operational capacity of the railway infrastructure, to select appropriate operational procedures, and to develop timetable concepts. They can take job positions in timetabling train path management and in supervision of train traffic control. They can also work in teams for the operational planning of construction and maintenance works. The students are familiar with the application of IT tools for capacity research and timetabling. They have the ability to evaluate the operational performance of railway lines and nodes under consideration of the constraints resulting from the infrastructure, and from signalling and vehicle constraints.

Literature

-Pachl, J.: Systemtechnik des Schienenverkehrs. 9. Aufl.,
-Vieweg Springer, Wiesbaden 2018, in der LV verteilte Materialien

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

Title	Transportation Planning		
Number	4318020	**Module version**	
Shorttext	BAU-STD2-7	**Language**	german
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Verkehr und Stadtbauwesen
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Bernhard Friedrich
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (90 Min.) or oral exam (30 Min.)		
Course achievement	Homework assignment		

Contents

[Verkehrsplanung (VÜ)]
- Introduction to transport planning
- Planning Methodology
- Behavioural traffic surveys
- Planning of transport networks
- Planning of measures in public transport (external lecturer from the field)
- Decision models
- Traffic models (traffic generation, traffic distribution, traffic allocation)
- Impact models and evaluation procedures
- Traffic safety

Objective qualification

The students gain an overview of the characteristics of mobility, the socio-economic significance of transport that can be derived from this and the resulting legal anchoring of spatial and transport planning. Based on the understanding of the problems and tasks of transport planning, the planning methodology and the instruments of transport network planning in public transport and individual transport are introduced. In this context, the students get to know the requirements of the German guidelines in transport planning and can apply them to planning tasks. Through the in-depth examination of the theory and practice of transport demand modelling, the students are enabled to carry out own planning studies and to quantitatively evaluate planning alternatives. They are thus qualified to make reliable recommendations for the development of the transport infrastructure.

Literature

vgl. Vorlesung

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

Title	Construction Engineering and Site Management		
Number	4321050	**Module version**	
Shorttext	BAU-STD2-3	**Language**	german
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Bauwirtschaft und Baubetrieb
Hours per Week / ECTS	5 / 6,0	**Module owner**	Prof. Dr. Patrick Schwerdtner
Workload (h)			
Class attendance (h)	70	**Self studying (h)**	110
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.)		
Course achievement			

Contents

[Construction Technology]
Lean construction; construction site enclosure; construction in groundwater; special formwork techniques; semi-precast components; scheduling and resource planning; bridge construction; cut and cover construction; risk management.

[Industrial Construction]
Basics of life cycle planning and serial production; chances and limitations of prefabrication; special aspects of logistics with a higher degrees of prefabrication; modular construction; use of semi-precast and precast components; serial production for facades and technical equipment; project execution models.

[Turnkey Construction]
Contractual peculiarities, typical regulations in general contractos and turnkey construction contracts; concretization of the performance target; technical aspects of general extension, facade and technical equipment; interface problems; tolerances; acceptance and organization of defect rectification.

[Health and Safety Management in Construction]
The students learn about the functioning of the statutory accident insurance and basic aspects of occupational safety.

Objective qualification

Based on Lean Construction principles, the students receive profound insights to specific aspects of construction methods incl. selected aspects in scheduling and risk management that will qualify the students for future jobs in construction site management.
In this context, students are able to consider fundamental aspects of occupational health and safety measures and are familiar with how statutory accident insurance work.
Optionally, after completing the module, students are also able to take into account the special characteristics of turnkey construction as a special form of organization and contract on the one hand or industrial construction with the special features of prefabrication during project preparation and implementation.
Students should be able to apply the principles of lean construction including the associated methods

Literature
zu [Bauverfahrenstechnik] ausführliches Skript zu [Schlüsselfertiges Bauen] Folienhandout zu [Sicherheit und Gesundheitsschutz im Bauwesen] div. Unterlagen der Bau-BG zu [Industrielles Bauen] Folienhandout

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Related courses			
Rules for the choice of courses			
Construction Operations (V) and Safety and Health Protection in Construction Engineering (V) are a compulsory subject. One of the following courses must be taken as an option: - Turnkey Construction (V) or - Industrial Construction (V)			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
	2,0	Lecture	german
	1,0	Lecture	german
	1,0	Lecture	german
	2,0	Lecture	german

Title	Warehousing and Data Mining Techniques		
Number	4214680	**Module version**	V2
Shorttext	INF-IS-68	**Language**	german
Frequency of offer	irregular	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Institut für Informations-systeme
Hours per Week / ECTS	3 / 5,0	**Module owner**	Prof. Dr. Wolf-Tilo Balke
Workload (h)	150		
Class attendance (h)	42	**Self studying (h)**	108
Compulsory requirements			
Expected performance/ Type of examina-tion	1 written exam (90 minutes), oral exam (30 minutes) or Take-Home-Exam		
Course achievement	50% of the exercises must be passed		

Contents

This module will give a broad overview over all methods that are necessary for building and using data warehouses in large-scale applications. Besides typical techniques for warehouse design, indexing, and online analytical processing (OLAP), also advanced data mining techniques, such as classification, cluste-ring, frequent item set mining, and association rules are covered in the lecture. In paticular,
- Statistical methods in databases
- Knowledge discovery and mining of local structures
- Frequent Item Set Mining and Association Rules
- Hierarchical and partitioning clustering algorithms
- (Linear) classification and support vector machines
- Architecture of data warehouses (ROLAP, MOLAP,...)
- Multi-dimensional data models (star, snowflake)
- Extraction, data transformation and cleaning
- Techniques for online analytical processing (OLAP)
- Storage- and Index structures for data warehouses

Objective qualification

Data warehousing and mining the data within warehouses represent an important basis for corporate deci-sion support. Students understand possible data warehouse architectures and their essential processes and know the details of the major data mining algorithms used, to be able to correctly and meaningfully underpin decisions with data. They are enabled to critically analyze and evaluate the respective application of various algorithms.

Literature

- William H. Inmon: Building the Data Warehouse. Wiley & Sons. ISBN 10: 0-7645-9944-5

- Ralph Kimball, Margy Ross: The Data Warehouse Toolkit. Wiley & Sons. ISBN 10: 0-471-0024-7

- Andreas Bauer, Holger Günzel: Data Warehouse Systeme. dpunkt Verlag. ISBN 10: 3-89864-251-8

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Data Warehousing and Data Mining Techniques	2,0	Lecture	english german
Literature			
- William H. Inmon: Building the Data Warehouse. Wiley & Sons. ISBN 10: 0-7645-9944-5 - Ralph Kimball, Margy Ross: The Data Warehouse Toolkit. Wiley & Sons. ISBN 10: 0-471-0024-7 - Andreas Bauer, Holger Günzel: Data Warehouse Systeme. dpunkt Verlag. ISBN 10: 3-89864-251-8			
	1,0	Exercise	english german

Title	Software Quality 1		
Number	4220480	**Module version**	V2
Shorttext	INF-SSE-48	**Language**	english german
Frequency of offer	only in the summer term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1 Semester	**Institution**	Institut für Softwaretechnik und Fahrzeuginformatik
Hours per Week / ECTS	4 / 5,0	**Module owner**	Sandro Schulze
Workload (h)	150		
Class attendance (h)	56	**Self studying (h)**	94
Compulsory requirements			
Expected performance/ Type of examination	1 written exam (90 min) or 1 oral exam (30 min) or 1 term paper or 1 Take-Home-Exam		
Course achievement			

Contents

1. Fundamental Basics (introduction, definition of terms, principles of software testing, general testing process, psychology of testing)

2. Testing in the software life cycle (general V-model, component testing, integration testing, system testing, acceptance testing, testing new product versions, overview of test types)

3. Static testing (structured group testing, static analysis, metrics)

4. Dynamic testing (black box testing, white box testing, experience-based testing)

5. Testmanagement (test organization and planning, economic aspects, testing strategies, test progress monitoring and control, failure management, requirements for the configuration management)

6. Testing tools (types, selection, introduction)

Objective qualification

After completing this module, the students will know the fundamental basics of software testing. They can apply the testing process and master activities and techniques to support it. The students will be able to define test cases in all phases of the software life cycle. They know common testing procedures and methods to efficiently and effectively prepare and execute software tests. The students will know both the underlying theoretical management processes as well as the practical testing tools to automate software testing.

Literature

Basiswissen Softwaretest von A. Spillner und T. Linz

Lehrbuch der Software-Technik (v.a. Bd. 2) von Helmut Balzert

Management und Optimierung des Testprozesses von M.Pol,
Tim Koomen, A. Spillner

Software-Test von Georg Erwin Thaller

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Related courses			
Rules for the choice of courses			
Compulsory attendance			
Name of the course	**SWS**	**Eventtype**	**Language**
Software quality 1	4,0	Lecture/Exercise	english german
Literature			
Basiswissen Softwaretest von A. Spillner und T. Linz Lehrbuch der Software-Technik (v.a. Bd. 2) von Helmut Balzert Management und Optimierung des Testprozesses von M.Pol, Tim Koomen, A. Spillner Software-Test von Georg Erwin Thaller			

Title	Practical Lab Training and Dimensioning of Treatment Plants		
Number	4398280	**Module version**	V1
Shorttext	BAU-STD3-3	**Language**	
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Siedlungswasserwirtschaft
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Thomas Dockhorn
Workload (h)			
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements	Prerequisite is prior participation in the module "Wastewater and Sludge Treatment"		
Recommended requirements	Students are expected to have a thorough knowledge of treatment processes for wastewater and sludge treatment in order to participate in this class.		
Expected performance/ Type of examination	The portfolio covers a detailed handout for each class, showing lab results and scientific discussion of the results or dimensioning drafts and scientific evaluation of the draft. Portfolios are design in independent teams under tuition of the lecturer. Lab results and scientific background will be presented to the class participants and the lab tutors in a final 30-minute seminar presentation. Grading will be based on participation during the lab days and on the quality of the presentation and on the corresponding student handout. Deregistration from the exam is possible up to wo weeks before the scheduled class participation. Dates for class presentations are scheduled in the first class meeting. The class Dimensioning and Design of Treatment Plants has a compulsory attendance of 16 hours (first class meeting, final class meeting). If students are absent with valid excuse (e.g. illness, child care etc.) individual solutions can be found for being able to complete the class successfully and still reach educational objectives of the class. Periods of absence may not exceed 15% of compulsory attendance, in order to reach educational objectives of the class. Practical Lab Training has a compulsory attendance of 40 hours (first class meeting, lab days, final class meeting). If students are absent with valid excuse (e.g. illness, child care etc.) individual solutions can be found for being able to complete the class successfully and still reach educational objectives of the class. Periods of absence may not exceed 15% of compulsory attendance, in order to reach educational objectives of the class.		
Course achievement			

Contents

[Dimensioning and Design of Treatment Plants (S)]
During the class, participants will work independently in student teams and will dimension the most important components of a wastewater treatment plant. Using the information and knowledge acquired in the prior classes on wastewater and sludge treatment as well as given dimensioning data, the students will design a wastewater treatment plant. Every other week meetings with the instructor and/or tutor will take place in order to discuss problems encountered during the work process. At the end of the semester each team will present its project to the class and discuss it with the participants and turn in a written report on the project work.

[Practical Lab Training on Wastewater Treatment (Ü)]
During the practical lab training, tutored lab experiments will be conducted in relation to current research projects of the institute (e.g. degradation experiments, precipitation/flocculation, respiration experiments, microscopic experiments, monitoring of experimental set-ups). Several tutored lab days will be arranged for conducting the experiments. Lab results and scientific background will be presented to the class participants in a final 30-minute seminar presentation. Grading will be based on participation during the lab days and on the quality of the presentation and on the corresponding student handout.

Objective qualification

Students are able to work independently in a research lab for wastewater and sludge treatment and discuss environmental engineering questions at a scientific level. They are able to independently acquire additional knowledge in the field of environmental engineering and can find solutions for wastewater problems at various levels. They are able to skillfully present their solutions to the public. A special focus in this seminar is on doing practical lab work, practicing teamwork, acquiring debate techniques and rhetorical skills and learning how to discuss controversial questions in a scientific setting.

Literature

Technical literature and additional information are available at the institute's library.

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Related courses

Rules for the choice of courses

Prior successful completion of the module 'Wastewater and Sludge Treatment' is pre-requisite for participating in this module. Students from other universities must have sufficient basic knowledge in the field of wastewater and sludge treatment.

Compulsory attendance

The class Dimensioning and Design of Treatment Plants has a compulsory attendance of 16 hours (first class meeting, final class meeting). If students are absent with valid excuse (e.g. illness, child care etc.) individual solutions can be found for being able to complete the class successfully and still reach educational objectives of the class. Periods of absence may not exceed 15% of compulsory attendance, in order to reach educational objectives of the class.

Practical Lab Training has a compulsory attendance of 40 hours (first class meeting, lab days, final class meeting). If students are absent with valid excuse (e.g. illness, child care etc.) individual solutions can be found for being able to complete the class successfully and still reach educational objectives of the class. Periods of absence may not exceed 15% of compulsory attendance, in order to reach educational objectives of the class.

Name of the course	SWS	Eventtype	Language
	2,0	Seminar	german
	2,0	Internship	german

Title	Landfill Technology and Remediation of Contaminated Sites		
Number	4398330	**Module version**	
Shorttext	BAU-STD-79	**Language**	
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	
Hours per Week / ECTS	4 / 6,0	**Module owner**	Dr. Kai Münnich
Workload (h)			
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.) or oral exam (approx. 30 Min.)		
Course achievement			

Contents

[Landfill Mining, Landfill Construction and Geotechnique of Wastes (VÜ)}
Fundamentals of waste mechanics und the hydarulic behaviour of wastes; interaction between the different parameters; constructive elements of landfills; emissions from landfills and their monitoring; longterm behaviour of landfills; position and after-use of landfills; Landfills in emerging and developing countries; legal basis.

[Investigation and Remediation of Contaminated Sites (VÜ)]
Contaminants in soil and groundwater; procedures for exploration; control of soil air; sampling of soil, soil air and groundwater; evaluation and assessment of analytical results; techniques for in-site and on-/off-sites remediation; procedures for groundwater treatment; biological, thermal and physical treatment of soils; after-use of contaminated sites; landfill mining.

Objective qualification

Students acquire in-depth knowledge of the construction and operation of landfills for municipal solid waste (MSW). The aspects of the position of the landfill in the waste management, the legal framework, the site search, the technical installations up to the aftercare, the monitoring and the landfill mining are considered. Furthermore, they gain detailed knowledge about the mechanical properties of waste as well as the long-term behavior in terms of water and gas emissions. Overall, there is a focus on the situation in emerging and developing countries. This will enable students to understand and evaluate the major dynamic processes of a landfill and to size the required structural components.

Students gain in-depth knowledge of the identification and remediation of contaminated sites. The basic aspects concerning possible pollutants, sources of input and exploration of the soil and groundwater are considered. The possible techniques for remediation of contaminated sites (biological, chemical and physical) are learned. The special case of remediation of old MSW dumps is elaborated in detail. This will enable students to assess a suspected contaminated site and select an appropriate remediation technique for the specific case.

Literature

Powerpoint slides
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/Exercise	german
	2,0	Lecture/Exercise	german

Title	Drinking Water Treatment, Water Chemistry and Wastewater Discharge		
Number	4398290	**Module version**	
Shorttext	BAU-STD2-64	**Language**	
Frequency of offer		**Teaching unit**	
Module duration	1	**Institution**	Institut für Siedlungswasserwirtschaft
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Thomas Dockhorn
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam (120 Min.) or oral exam (approx. 60 Min.)		
Course achievement			

Contents

[Drinking Water Treatment]
The class introduces basic processes of drinking water treatment, legal regulations and drinking water standards. It presents treatment processes such as decarbonisation, flocculation, filtration, removal of iron and manganese, calcium carbonate equilibrium, processes for water softening, removal of organic compounds and water disinfection. The class also discusses world-wide problems concerning drinking water supply and treatment.

[Discharge of Municipal Wastewater (VÜ)]
The course presents a general introduction on various aspects of sewer systems. The class consists of three theoretical class meetings and two field trips. Class meetings cover the topics sewer net hydraulics, dimensioning of sewers, sewer inspection, pipes, pipe materials, separate and combined sewer systems. The field trips present the practical aspects such as manhole entry, sewer construction zones and an Oker boat tour in regard to drinking water aspects.

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

Objective qualification

[Drinking Water Treatment]
Students gain general knowledge of all questions concerning drinking water production, supply and treatment. They are able to dimension drinking water treatment plants. They understand world-wide concerns in regard to drinking water supply and treatment. They are able to critically discuss various treatment options and find adequate solutions taking into consideration social, scientific and ethical concerns.

[Discharge of Municipal Wastewater]
Students gain advanced knowledge of modern sewer systems and are able to analyse and understand hydraulic, topographic and operational correlations in a sewer system. They are able to design new

sewer systems and evaluate existing systems. They are able to critically discuss problems of wastewater discharge and find adequate solutions taking into consideration environmental, scientific and ethical concerns.

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

Literature

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

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Related courses

Rules for the choice of courses

Two out of the tree offered classes must be selected. The course Water Chemistry and Analysis cannot be chosen in the Master's programme in Environmental Engineering.

Compulsory attendance

The class ‘Discharge of Municipal Wastewater’ has compulsory attendance (first class meeting, theoretical lectures, field trips). Participation in the theoretical lessons is pre-requisite to understand the problems presented in the field trips. If students are absent with valid excuse (e.g. illness, child care etc.) individual solutions can be found for being able to complete the class successfully and still reach educational objectives of the class. Periods of absence may not exceed 15% of compulsory attendance, in order to reach educational objectives of the class

Name of the course	SWS	Eventtype	Language
	2,0	Lecture/Exercise	german
Water Chemistry and Water Analytics	2,0	Lecture/Exercise	german
Drinking Water Treatment	2,0	Lecture/Exercise	german

Title	Innovative Energy Systems		
Number	2423600	**Module version**	
Shorttext	ET-HTEE-60	**Language**	
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	oral exam (30 min) or written exam (90 min)		
Course achievement			

Contents

1. Development of Energy Supply and Climate Targets
2. Conventional Power Plants
3. Renewable Energies
4. Novel generation systems
5. Power-to-X and Sector Coupling (Transport, Heat)
6. Storage (Battery, Hydrogen)
7. Island Grids
8. Prosumer Households

Objective qualification

After completing the module, students will be able to describe the conventional and sustainable provision of electrical
energy as well as associated current and future developments on the basis of basic knowledge. In addition to the
provision of electrical energy, students will be able to identify various approaches to sector coupling (transport, heat) and
possibilities for storing energy (battery storage, hydrogen, etc.).
This module enables students to explain future requirements and changes in the energy system and to list possible
advantages and disadvantages. Measures and goals in the context of potential transformations (energy transition,
mobility transition, etc.) can be classified and assessed in the overall context of a sustainable energy supply.

Literature

Quaschning, Volker: Regenerative Energiesysteme: Technologie – Berechnung – Simulation. München 2015. Hanser Verlag. Kaltschmitt, Martin: Erneuerbare Energien: Systemtechnik, Wirtschaftlichkeit, Umweltaspekte. Berlin 2013. Springer Vieweg.
Heuck, Klaus; Dettmann, Klaus-Dieter; Schulz, Detlef: Elektrische Energieversorgung: Erzeugung, Übertragung und Verteilung elektrischer Energie für Studium und Praxis. Wiesbaden 2013. Springer Vieweg.

Schwab, Adolf J.: Elektroenergiesysteme: Erzeugung, Übertragung und Verteilung elektrischer Energie. Berlin 2015. Springer Vieweg.

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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			
Die Energiefrage Bedarf und Potentiale, Nutzung, Risiken und Kosten, K. Heinloth, Vieweg			
	2,0	Exercise	german

Title	Traffic Management		
Number	3319000010	**Module version**	
Shorttext		**Language**	
Frequency of offer	only in the summer term	**Teaching unit**	
Module duration	1	**Institution**	Institut für Verkehr und Stadtbauwesen
Hours per Week / ECTS	4 / 6,0	**Module owner**	Prof. Dr. Bernhard Friedrich
Workload (h)	180		
Class attendance (h)	56	**Self studying (h)**	124
Compulsory requirements			
Expected performance/ Type of examination	Written exam+ (90 Min.) or oral examination (ca. 30 Min.) Two assignments can be completed in advance which, if passed, count for 25% of the final grade for the module. The application for an written exam+ must be submitted by the student at the start of the examination. Further information on deadlines for the submission of term papers is provided in the courses of the module.		
Course achievement			

Contents

- Functional and organisational system architectures for the management of road traffic facilities
- Traffic flow theory as the basis for determining the traffic situation and evaluating measures
- Recording, processing and analysing traffic data (practical course)
- Design and traffic engineering dimensioning of road traffic facilities
- Procedures and methods of traffic control for road network, road sections and junctions within (urban roads) and outside built-up areas (motorways)
- Procedures for determining the traffic situation and quality management
- Insights into practice through guest lectures and excursions

Objective qualification

Students gain a comprehensive overview of the responsibilities, tasks and objectives of the management of road traffic facilities inside and outside built-up areas. In this context, system architectures for traffic management in Germany are introduced in their functional and organisational forms. Students learn the basics of traffic data analysis and traffic flow theory in order to be able to competently deal with the tasks of traffic management and, building on this, to apply state-of-the art methods for the dimensioning of road traffic facilities and the various methods of traffic control in accordance with the regulations applicable in Germany. This gives students the skills to develop and evaluate measures that make sense from a traffic flow perspective and are ecologically and economically suitable. Taking into account the existing traffic infrastructure, they will be able to dimension road traffic systems on urban roads and motorways that meet the standards of German guidelines and equip them with the necessary traffic engineering systems (operation).

Literature

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

Master's Thesis	**30 ECTS**

Title	Master's Thesis		
Number	2299780	**Module version**	
Shorttext	WW-STD-78	**Language**	english german
Frequency of offer	every term	**Teaching unit**	Carl-Friedrich-Gauß-Fakultät
Module duration	1	**Institution**	Department Wirtschafts-wissenschaften
Hours per Week / ECTS	0 / 30,0	**Module owner**	Studiendekan der Wirt-schaftswissenschaften
Workload (h)	900		
Class attendance (h)	30	**Self studying (h)**	870
Compulsory requirements			
Expected performance/ Type of examina-tion	1 written assignment		
Course achievement			

Contents
Development of a topic from the chosen business specialization
Objective qualification
Students can work on topics in research at the interface between management and technology. They identify problems independently, can incorporate current research results into their overar-ching analyses and can structure their work and its preparation. They apply research methods and present their results in a written paper as well as in the Master's colloquium.
Literature
depending on the concrete task

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