HOCHSCHULE
RHEIN-WAAL
Rhine-Waal University
of Applied Sciences

Modulhandbuch für den Studiengang

Mobility and Logistics, B.Sc.

Faculty of Communication and Environment

Version 6.2

24.09.2021

Dokumentenhistorie

Hinweis zur Versionen

- Jede Änderung führt zu einer neuen Version. Sobald Module ausgetauscht werden, inhaltlich neu ausgerichtet werden oder sich der Name des Moduls ändert, wird die Version um 1 erhöht. Alle kleinen Änderungen führen um eine Erhöhung rechts vom Komma.
- Die Modulnummer ist mit dem Modulnamen verknüpft. Sollte ein Modul wegfallen, so kann die Modulnummer nicht erneut vergeben werden.

Version	Datum	Verantw.	Bemerkung
1.0			Version für die Akkreditierung
1.1	11.10.2013	Schürholz	ML_2.06: Project management and Intercultural Competence Anpassung/Ergänzung Beschreibungen “Learning outcomes“ und “Content“ an/um internationale/ interkulturelle Anforderungen
2.0	11.10.2013	Schürholz	ML_5.01 Traffic Systems Namensänderung in “Traffic Logistics and Mobility”
2.1	11.10.2013	Schürholz	ML_5.01 Traffic Logistics and Mobility Anpassung/Ergänzung der Beschreibungen “Learning outcomes“ und “Content“ an/um Inhalte des ÖPNV und Mobilität
3.0	11.10.2013	Schürholz	ML_5.02 Legal Regulations and Customs Requirements Namensänderung in “ Legal requirements and international regulations ”
3.1	11.10.2013	Schürholz	ML_5.02 Legal requirements and international regulations Anpassung/Ergänzung der Beschreibungen “Learning outcomes“ und “Content“ an/um internationale Anforderungen und Regelungen
3.2	11.10.2013	Schürholz	ML_5.02 Legal requirements and international regulations Änderung„Person in charge“ in: Prof. Dr. Schwind
4.0	11.10.2013	Schürholz	Vertauschung ML_3.03 “Identification and Automation“ mit ML_4.3 ”Technical Innovations in Logistics and Society”
5.0	11.10.2013	Schürholz	ML_3.03 : ”Technical Innovations in Logistics and Society” Namensänderung in “Technical Innovations in Logistics and Mobility”

5.1	11.10.2013	Schürholz	ML_3.03 Technical Innovations in Logistics and Mobility - Anpassung/Ergänzung der Beschreibungen “Learning outcomes“ und “Content“ an/um Inhalte des ÖPNV und Mobilität - Änderung von ”Type of assessment“ in “Certificate (Testat)” - Änderung von “Requirements for credits” in “presentation of an assigned topic” - Änderung“Person in charge“ in: Prof. Dr. Schürholz
5.2	11.10.2013	Schürholz	ML_1.06 Introduction to Scientific working Änderung“Person in charge“ in: Prof. Dr. Michael Schwind
5.3	11.10.2013	Schürholz	ML_3.01 Accounting Änderung“Person in charge“ in: Prof. Dr. Franka Ruhwedel
5.4	11.10.2013	Schürholz	ML_4.01 Controlling Änderung“Person in charge“ in: Prof. Dr. Franka Ruhwedel
5.5	18.10.2013	TH	Curriculum angepasst (Namensänderung)
5.6	27.11.2013	TH	Abschnitt „Assessment Strategies and Methods“ eingefügt
5.7	28.11.2013	TH	Kleinere Korrekturen
5.8	19.01.2015	AR	Überschrift geändert (Degree Programm)
5.9	26.01.2015	Schürholz	ML_3.01 Accounting: Inhaltliche Überarbeitung
5.10	26.01.2015	Schürholz	ML_4.01 Controlling Inhaltliche Überarbeitung
5.11	06.09.2016	Bruckmann	ML_2.01 Änderungen „Person in Charge“ in Prof. Dirk Bruckmann
5.12	06.09.2016	Bruckmann	ML_2.06 Änderung “Person in Charge” in Prof. Dr. Dirk Bruckmann; Ergänzung Literaturliste
5.13	06.09.2016	Bruckmann	ML_5.01 Änderung „Person in Charge“ in Prof. Dr. Dirk Bruckmann, Komplettrevision der Modulinhalte
5.14	06.09.2016	Bruckmann	ML_W.05 Änderung „Person in Charge“ in Prof. Dr. Dirk Bruckmann, Ergänzung der Literaturliste
5.15	06.09.2016	Bruckmann	ML_W.03 Änderung „Person in Charge“ in Prof. Dr. Dirk Bruckmann, Anpassung der Lehrinhalte, Ergänzung der Literatur zu „Airport Logistics“

5.16	06.09.2016	Bruckmann / Schwind	ML_W.08 Neues Wahlpflichtmodul „Basic Methods of Advanced Logistics Control“
5.17	29.06.2016	Bruckmann	ML_W.09 Neues Wahlpflichtmodul „Mobility Management and Traffic Control“
6.0	31.05.2018	Bruckmann / Kalhoff	Komplette Überarbeitung Module und Anpassung Curriculum – Dirk Bruckmann, Agatha Kalhoff
6.1	07.01.2021	Bruckmann	Anpassung der Prüfungsformen in den Modulen gemäß Auflage zur Reakkreditierung von AQAS: ML_2.01 Technical Logistics Systems
6.2	24.09.2021	Bruckmann	Anpassung der Modulnamen an die Prüfungsordung in der Fassung vom 09.12.2020

Assessment Strategies and Methods

In consultation with the examiners, the Examination Board decides on the form of assessment and in case of a written examination on its duration, before the beginning of each course. The decisions of the Examination Board are binding and apply uniformly to all examination candidates. They are either to be announced by notices displayed on the faculty's notice board or communicated electronically (According to the General Examination Regulations, Section 14, Paragraph 1, this is sufficient).

In the first semesters the core knowledge and understanding is usually assessed through written examinations. In advanced semesters the assessment of learning outcomes is mainly focused on seminar papers, coursework reports, project work and/or oral examinations.

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HOCHSCHULE RHEIN-WAAL
Rhine-Waal University of Applied Sciences

Curriculum of the Degree Programme Mobility and Logistics, B.Sc.

Version vom 09.12.2020

Code No (Kennnummer)	Module	SW (SWS)	L (V)	SL (SL)	S (S)	Ex (Ü)	PT (Pra)	Pro (Pro)	TE (Prü)	CP (CP)	WS1	SS2	WS3	SS4	WS5	SS6	WS7
		Type (Veranstaltungsart)															
ML_1.01	**Fundamentals of Business Administration** (Grundlagen der Betriebswirtschaft)	4	2			2			E (P)	5	4					**ML_5.01: Internship or semester abroad (30 CP ; TE: C(T))** (Praxis- oder Auslandssemester)	**ML_7.01: Workshop 1: Research Methods** (Forschungsmethoden) (4 SW; 5 CP; type S; TE: C(T)) **ML_7.02: Workshop 2: Scientific Writing** (Wissenschaftliches Schreiben) (4 SW; 5 CP; type S; TE: C(T)) **ML_7.03: Workshop 3: Advanced Seminar** (Hauptseminar) (4 SW; 5 CP ; type S ; TE: C(T)) **ML_7.04: Bachelor Thesis** (Bachelorarbeit) (12 CP) **and Colloquium** (Kolloquium) (3 CP)
ML_1.02	**Fundamentals of Logistics** (Grundlagen der Logistik)	4	2			2			E (P)	5	4						
ML_1.03	**Technical Fundamentals** (Technische Grundlagen)	4	2			2			E (P)	5	4						
ML_1.04	**Fundamentals of Computer Science and Networks** (Grundlagen der Informatik)	4	3			1			E (P)	5	4						
ML_1.05	**Analysis and discrete mathematics** (Analysis und diskrete Mathematik)	4	2			2			E (P)	5	4						
ML_1.06	**Introduction into Scientific Working** (Einführung in das wissenschaftliche Arbeiten)	4		4					C (T)	5	4						
ML_2.01	**Technical Logistic Systems** (Technische Logistik Systeme)	4	2			2			E (P)	5		4					
ML_2.02	**Planning Logistics Systems and Processes** (Logistische System- und Prozessplanung)	4	2			2			E (P)	5		4					
ML_2.03	**Statistics** (Statistik)	4	2			2			E (P)	5		4					
ML_2.04	**Object Oriented Programming** (Objektorientierte Programmierung)	6	2			4			E (P)	5		6					
ML_2.05	**Linear algebra and graph theory** Lineare Algebra und Graphentheorie	4	2			2			E (P)	5		4					
ML_2.06	**Project Management** Projektmanagement	4		4					C (T)	5		4					
ML_3.01	**Financial and Management Accounting** (Buchhaltung und Rechnungswesen)	4	2			2			E (P)	5			4				
ML_3.02	**Production Logistics** (Produktionslogistik)	4	2			2			E (P)	5			4				
ML_3.03	**Decision Making Methods** (Entscheidungsverfahren)	4		4					C (T)	5			4				
ML_3.04	**Data Management** (Datenmanagement)	4	2			2			E (P)	5			4				
ML_3.05	**Linear optimization and operations research** (Lineare Optimierung und Operations Research)	4	2			2			E (P)	5			4				
ML_3.06	**Traffic Planning and Engineering** (Verkehrsplanung und Verkehrstechnik)	4	2			2			E (P)	5			4				
ML_4.01	**Logistics and Traffic Infrastructures** (Logistikanlagen und Verkehrsinfrastrukturen)	4	2			2			E (P)	5				4			
ML_4.02	**Supply Chain Management** (Supply Chain Management)	4	2			2			E (P)	5				4			
ML_4.03	**Identification & Automation** (Identifikation & Automatisierung)	4	2			2			E (P)	5				4			
ML_4.04	**Business Information Systems** Betriebliche Informationssysteme	4		4					C (T)	5				4			
ML_5.01	**Freight Logistics** (Gütertransport)	4	2			2			E (P)	5					4		
ML_5.02	**Legal requirements and international regulations** (Rechtliche Anforderungen und internationale Richtlinien)	4	2			2			E (P)	5					4		
ML_5.03	**Interdisciplinary Project** (Interdisziplinäres Projekt)	6						6	E (P)	10					6		
	Elective courses * Wahlpflichtkurse *	16								20				8	8		
	Semester hours per week (total)	**120**								**150**	24	26	24	24	22	30	30

120 SW — 12 SW

150 CP — **60 CP**

Credit Points: 210

				WS1	SS2	WS3	SS4	WS5	SS6	WS7
Allocation	SW	total	132	24	26	24	24	22		12
	CP	total	210	30	30	30	30	30	30	30

Code No (Kennnummer)	Elective Courses (Wahlpflichtkurse)	SW (SWS)	CP (CP)	TE (Prü)
ML_W.01	**Logistic Simulations** Logistik Simulation	4	5	E (P)
ML_W.02	**Lean Management** Lean Management	4	5	E (P)
ML_W.03	**Harbour and Airport Logistics** Hafen und Flughafen Logistik	4	5	E (P)
ML_W.04	**Procurement and Distribution Logistics** Beschaffungs- und Distributions-Logistik	4	5	E (P)
ML_W.05	**Strategic Managment and Business Planning** Strategisches Management und Businessplanung	4	5	E (P)
ML_W.06	**Quality and Risk Management** Qualitäts- und Risikomanagement	4	5	E (P)
ML_W.07	**Ambient Intelligent Systems** Ambient Intelligent Systems	4	5	E (P)
ML_W.08	**Geoinformation Systems** Geoinformationssysteme	4	5	E (P)

Abkürzungen/Abbreviations

SW (SWS)	Semester hours per week (Semesterwochenstuden)
L (V)	Lecture (Vorlesung)
SL	Seminaristic lecture (Seminaristische Lehrveranstaltung)
S	Seminar (Seminar)
Ex (Ü)	Exercise (Übung)
PT (Pra)	Practical training (Praktikum)
Pro	Project (Projekt)
TE (Prü)	Type of examination (Prüfungsform)
CP	Credit Points
WS	Winter semester (Wintersemester)
SS	Summer semester (Sommersemester)
E (P)	Examination (Prüfung)
C (T)	Certificate (Testat)

** Im Wahlpflichtbereich können mit vorhergehender Zustimmung des Prüfungsausschussesmaximal 5 CP fachlich geeigneter Kurse aus dem gesamten Studienangebot der Hochschule Rhein- Waal belegt werden. Als fachlich geeignete Kurse gelten entsprechend ausgewiesene Sprachkurse des Sprachenzentrums sowie Wahlpflichtkurse anderer technischer und ökonomischer Studiengänge der Hochschule Rhein-Waal.*
** As elective subjects, a maximum of 5 CP of appropiate courses can be chosen wth the consent of the examination committee from any study programme at the Rhine-Waal University of Applied Sciences. Appropiate courses are the designated language courses from the language center and elective courses from other technical or economical degree programmes.*

*** Die Fakultät behält sich das Recht vor eine Mindestteilnehmerzahl für das Zustandekommen eines Wahlpflichtkurses festzulegen. Die Möglichkeit des Erreichens der vorgeschriebenen Kreditpunktanzahl aus dem Wahlpflichtbereich bleibt unberührt.*
*** The faculty reserves the right to determine a minimum number of participants for offering an elective subject. The possibility to obtain the required number of credit points remains unaffected.*

ML_1.01 Fundamentals of Business Administration

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_1.01	150 h	5 CP	1st Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	Lecture: open Exercise: 40 students

Learning outcomes / Competences and qualifications profile

Students have gained an understanding of fundamental concepts of business administration and the basic functions of organizations. They have a good grasp of important terms, concepts, and methods and are able to apply them to real-life problems. They have discussed the impacts of globalization and can describe its influence on business processes.

Content

- An organization and its goals
- Corporate organization and organizational structure
- Principles of strategic management and planning
- The operations function: the process of production, costs and planning, production logistics
- Fundamentals of marketing: the marketing mix
- Principles of finance
- The controlling function
- Fundamentals of human resource management and leadership

Teaching methods

Lectures, accompanied by exercises in which case studies and problems in practice are presented

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)

Same module in "Communication and Information Engineering", "International Business Administration" and "Mobility and Logistics"

Weight towards final grade 3.45%
Person in charge of module Anna Seidel
Additional information Reading: Gamble, J. E. / Thompson, A. A. (2011): Essentials of Strategic Management. The Quest for Competitive Advantage. 2nd edition. New York: McGraw-Hill. Hill, C. W. L. (2009): International Business. Competing in the Global Marketplace. 7th edition. New York: McGraw-Hill. Kotler, P. / Armstrong, G. (2010): Principles of Marketing. 13th edition. Upper Saddle River: Pearson Prentice Hall. Luthans, F. / Doh, J. P. (2009): International Management. Culture, Strategy, and Behavior. 7th edition. New York: McGraw-Hill. Robbins, Stephen P. / DeCenzo, David A. / Coulter, Mary (2011): Fundamentals of Management. Essential Concepts and Applications. 7th edition. Upper Saddle River: Pearson Prentice Hall. Slack, N. / Chambers, S. / Johnston, R. (2010): Operations Management. 6th edition. Harlow: Pearson Prentice Hall.

ML_1.02 Fundamentals of Logistics

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_1.02	150 h	5 CP	1st Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

This module has introduced students to the main fields of logistics of a productive company such as: procurement-logistics, production-logistics and distribution-logistics

Students have gained a sound understanding of external transport modes (road, train, ship, rail) and of logistic organization structures.

They are able to understand the main tasks, objectives, structures and processes in these areas as well as the interdependencies of material and information flows.

They are also able to analyse the main objectives of a company and define Key Performance Indicators (KPI) to measure the cost, service and performance of logistics.

Students can acquire the skills they need to calculate logistics costs for road and container transports depending on the packing schemes and different load structures of the capacities.

Successful students can apply his knowledge of cost calculation as well as analyzing and structuring of logistic systems in the above mentioned areas in a professional context.

Content

- Main processes and structures of procurement-, production- and distribution logistics
- Different forms of delivery processes (regular, JIT, JIS) and methods of material classification (ABC/XYZ)
- Main forms and means of external transports (road, rail, water, air) / their advantages and disadvantages
- Basics of transport regulations (incoterms) and transport cost calculation
- Main Key Performance Indicators (KPI) for logistic-cost, logistic-service and logistic-performance
- Basic functionalities of MRP / MRP II, main master data, material requirement planning, basics of capacity planning, example of the load oriented order release
- Vertical and horizontal distribution structures, different storage levels and forms of warehouses, example of a typical distribution warehouse
- Basic structures of logistics organizations within a company

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

None

Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Andreas Schürholz
Additional information

ML_1.03 Technical Fundamentals

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_1.03	150 h	5 CP	1st Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	Open

Learning outcomes / Competences and qualifications profile

This module has introduced students to selected key principles of Physics. The successful student is able to apply the physical concepts, laws and equations he has learned in advanced modules and in his or her professional life. The student is able to describe simple motion mathematically, can decompose forces and has a sound understanding of the physical concepts work, energy and power.

The student has understood the principal of energy conservation and is able to solve given tasks concerning the topics mentioned above. The student is also able to describe simple harmonic oscillation/waves, calculate the natural frequency of simple oscillating systems, has a sound understanding of period and wave length and is able to solve basic tasks including superpositioning of waves. Furthermore the student has understood the principals of electromagnetic induction and current and can apply this knowledge in advanced modules (for example while talking about RFID).

Content

- Examples for today's use of technical systems in logistic processes.
- Physical quantities and units
- 1D and 3D motion
- Forces and Newton's laws
- Work, energy, power
- Osscillations, waves & superposition
- Electrical charges & electric fields
- Electrostatic potential & electric energy
- Current & Ohm's law
- Kirchhoff's rules
- Magnetic field
- Electromagnetic induction

Teaching methods

Lectures and practical classes

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points Passed examination
Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Christian Ressel
Additional information Literature: Paul A. Tipler, Gene Mosca: "Physics for Scientists and Engineers", enlarged 6th edition; W.H. Freeman, 2007. David Halliday, Robert Resnick, Jearl Walker: " Fundamentals of Physics", 9th Edition; Wiley , John & Sons, 2010

ML_1.04 Fundamentals of Computer Science and Networks

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_1.04	150 h	5 CP	1st Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 33.75 h / 3 semester hours per week (SWS) Exercise: 11.25 h / 1 SWS	45 h / 4 SWS	105 h	45 Students

Learning outcomes / Competences and qualifications profile

This module has introduced students to the key principles of computers and networks. Successful students have gained the ability to identify the major hardware and software components of a computer system, to understand their relationship to one another and the importance of these components within the system. They are also able to convert numbers from different numeral systems, which are frequently used by computer systems, and can express conditions and causality using binary logic.

Furthermore students have gained an understanding of how computer networks work. They are able to explain the ISO/OSI reference model and IP traffic and can set up small networks independently.

Content

- Example for today's use of computers in different environments
- Basic principles: numeral systems, representation of text, combinational logic
- Hardware of a computer system, incl. CPU, motherboard, storage devices, RAID and backup systems
- Introduction to operating systems, incl. common operating systems
- Computer networks: network classifications, ISO/OSI reference model, layers of IP networks, network devices, basic security

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)

Same module in “Energy and Environment”, "Communication and Information Engineering", and "Mobility and Logistics"

Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Christian Ressel
Additional information Literature: Clements, A.:Principles of COMPUTER HARDWARE, ISBN 978-0-19-927313-3, Oxford University Press, 2006 (4th edition Mafield,C.: Bebop - to the boolean boogie,ISBN 1856175073, Newnes, 2008 (3rd. edition) Tannenbaum,A.: Computer Networks, ISBN 0130661023, Prentice Hall, 2002 (4th. edition) Muller, J.-M. et al.: Handbook of Floting Point Arithmetic, ISBN 081764704X, Springer, 2009 Brent, R. P.; Zimmermann, P.: Arithmetic (Cambridge Monograph on Applied and Computational Mathematics), ISBN 0521194695, Cambridge University Press, 2010

ML_1.05 Analysis and Discrete Mathematics

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_1.05	150 h	5 CP	1st Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	Lecture: open Exercise: 30 students

Learning outcomes / Competences and qualifications profile

This lecture introduced students to the basics of Discrete Mathematics and fundamental topics of Analysis. Students will have learned how to use Analysis to solve practical problems linked to engineering and logistics.

With the knowledge of the mathematical methods and formulas students can solve analytical problems based on discrete or continuous functions and are able to apply their knowledge to their professional context as analysts, planners or engineers.

Additionally, students are able to develop advanced solutions to describe and optimize technological functionalities in a mathematical way by using basic trigonometric functions as well as main formulas and procedures of differential and integral calculus.

Content

- Fundamentals of set theory, sets of numbers
- Complex numbers, Cartesian coordinates, polar coordinates
- Definition and calculation of limits, rule of L'Hôpital
- Fundamental functions - polynomial -, potential -, exponential, logarithm -, and trigonometric functions
- Properties and graphs of functions, continuity, differentiability
- One- and two-dimensional differential calculus, partial derivatives, Hessian Matrix
- Taylor series, extremal points, applications
- Integral calculus, anti-derivatives, definite and indefinite integrals
- Partial integration, integration by substitution, calculating areas and surfaces

Teaching methods

Tuition in lectures and practical classes

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points Passed examination
Use of module (in other study programs) Same module in "Communication and Information Engineering" and "Mobility and Logistics"
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Agatha Kalhoff
Additional information Literature: Brown, Arlen, Pearcy, Carl: An Introduction to Analysis, Springer, 1995 Marco Baronti, Filippo de Mari, Robertus van der Putten, Irene Venturi: Calculus Problems, Springer, 2016 James Stewart: Calculus, Early Transcendentals, International Metric Edition, 6th Edition, BrooksCole, 2008; ISBN-13: 9780495382737 Gerald Teschl, Susanne Teschl: Mathematik für Informatiker, Bd. 2 Analysis und Statistik, 2. Auflage, Springer, 2007

ML_1.06 Introduction to Scientific Working

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_1.06	150 h	5 CP	1st Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Seminaristic lecture: 45 h / 4 semester hours per week (SWS)	45 h / 4 SWS	105 h	Seminaristic lecture: 30 students

Learning outcomes / Competences and qualifications profile

This course enables students to explain the purposes and name the stakeholders of research and science. Students are able to define a topic, border it adequately and find literature on the topic. The can formulate their own research question. They have also acquired the skills to evaluate literature efficiently and critically and write a well-structured seminar paper applying either footnotes or Harvard citation style. Furthermore students know what criteria pieces of scientific writing have to meet and can give a convincing and to the point oral presentation about their research findings.

Content

- What is research and science? What purpose do they serve?
- Where is research produced? Different stakeholders in the field of research.
- Research methods in social and technical sciences.
- Finding a suitable topic and bordering the topic.
- Literature search: Sources and searching methods, relevance of literature, quality of literature.
- Reading techniques: Efficient reading, critical reading.
- Scientific writing: Different genres of scientific writing - summary, response paper, policy paper, seminar paper, bachelor thesis, master thesis, research proposal, research paper, literature review.
- Structuring the topic; the elements of a seminar paper, time management
- Effective search of scientific and relevant literature
- Citations: What purpose do citations serve? Citations with footnotes, citations in Harvard Style
- References vs. bibliography: Purposes and formats
- Graphs, diagrams and tables
- Evaluation criteria for pieces of scientific writing
- Oral presentation of research results: Demands, preparation, methods, evaluation criteria.

Teaching methods

The course is mostly taught in seminaristic lectures in which students discuss different topics of scientific working. Small research and writing exercises will be part of the course to directly apply what has been learned. In the later part of the course students present their seminar papers. Their results, the scientific approach as well as the style of the oral presentation are discussed.

Entry requirements

None

Types of assessment Certificate (Testat)
Requirements for the award of credit points Written assignments, seminar papers and oral presentation delivered have to meet quality criteria to pass
Use of module (in other study programs) Same module in "Communication and Information Engineering", "E-Government", "International Business Administration", "Media Communication and Computer Sciences" and "Mobility and Logistics"
Weight towards final grade None (ungraded)
Person in charge of module Sabine Lauderbach
Additional information Reading: Esselborn-Krummbiegel, H. (2008): Von der Idee zum Text. Eine Anleitung zum wissenschaftlichen Schreiben. 3rd edition. Stuttgart: UTB / Schöningh. Franck, N. / Stary, J. (2009): Die Technik wissenschaftlichen Arbeitens. 16th edition. Stuttgart: UTB / Schöningh. Hofmann, A. H. (2010): Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford: Oxford University Press. Russey, W. E. / Ebel, H. F. / Bliefert, C. (2006): How to Write a Successful Science Thesis: The Concise Guide for Students. Chichester: Wiley. Hofmann, A. H. (2010): Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford: Oxford University Press. Bright, W. (1990): An Introduction to Scientific Research. Dover Ed. New York Glasman-Deal, H. (2010): Science Research Writing, Imperial College Press, London.

ML_2.01 Technical Logistics Systems

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_2.01	150 h	5 CP	2nd Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

Students have developed a solid understanding of the material flow technologies which are needed to realize transport, handling and storing processes in intralogistics systems. They are able to classify various material flow systems and to assess the capacity of different systems.

Students have a broad knowledge of packing, load units and load securing on vehicles. They are able to assess different methods of load securing including the calculations required.

Students are able to distinguish different types of warehouses. This includes different storage systems and storage strategies as well as key figures of warehouses. They also have a solid understanding of the basic techniques of picking and sorting.

Content

- Different forms and materials of packaging
- Building load units and load securing on vehicles
- Main techniques and systems for conveying, their classification and the assessment of their capacities
- Main systems and techniques for the storage of goods, their classification and fields of application
- Strategies for warehouse organizations, key performance indicators for warehouses
- Different strategies and techniques of picking including capacity calculations
- Different forms of sorters

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

None

Types of assessment

Graded examination (written examination)

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Dirk Bruckmann
Additional information Literature: Arnold, D. and K. Furmanns (2009) Materialfluss in Logistiksystems, 6th edition, Springer, Heidelberg. Berufsgenossenschaft für Fahrzeughaltungen, Technischer Aufsichtsdienst (ed.) (2002) Ladungssicherung auf Fahrzeugen, Ein Handbuch für Unternehmer, Einsatzplaner, Fahr- und Ladepersonal, DGUV Information 214-003, 3rd edition, Hamburg. Gleissner, H. and J.C. Femerling (2013) Logistics - Basics, Exercises, Case Studies, Springer Texts in Business and Economics, Cham. Jodin, D. and M. ten Hompel (2012) Sortier- und Verteilsysteme, 2nd edition, Springer Vieweg, Berlin, Heidelberg. ten Hompel, M., Sadowsky, V. and M. Beck (2011) Kommissioniersysteme, Materialflusssysteme 2, Planung und Berechnung der Kommissionierung in der Logistik, Springer, Berlin. ten Hompel, M., Schmidt, Th. and L. Nagel (2007) Materialflusssysteme, Förder- und Lagertechnik, Springer, Berlin. Verein Deutscher Ingenieure VDI (ed.) Securing of loads on road vehicles, VDI 2700, draft, Beuth Verlag, Berlin.

ML_2.02 Planning of logistic systems and processes

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_2.02	150 h	5 CP	2nd Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

This module has introduced students to the analysis and optimization of logistic processes in general. Students have learned how to plan a factory or logistic site in detail, starting with site location planning and the general land-use plan, and then working their way up from draft to detailed layout planning.

The succesful student is expected to be able to:

- apply his knowledge about logistic process analysis and layout planning to his professional context and needs.
- evaluate and compare different layouts
- find an optimal arrangement of layout areas
- read a general land-use plan and
- dimension the logistic areas in a planned building.

Content

- Logistic process analysis and planning, logistic potential classes, basics of logistic process optimization
- Comparison and evaluation of materialflow and layout variants
- Draft layout planning: methods of optimized planning and arangements of layout areas
- Different forms of draft plant layouts (spine structures)
- General location planning, regional and local evaluation factors, methods of optimized location planning
- General "land-use" plan (master plan): elements of content, key figures, general procedure of master planning
- Detailed planning: general procedure, determination of amount of resources, calculation of area sizes

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Andreas Schürholz
Additional information

ML_2.03 Statistics

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_2.03	150 h	5 CP	2nd Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 6 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

Students who have completed this module are able to make appropriate decisions based on business and social data. They can select suitable statistical techniques for collecting, summarizing and displaying data. They are also able to analyze and draw inferences from data using appropriate statistical methods and computer software. Students have developed the skills to interpret and communicate the results of a statistical analysis in the context of a business problem or an empirical investigation of a social phenomenon.

Content

Descriptive statistics:

- Basic concepts (Levels of measurement, univariate data, bivariate data, types of data)
- Sampling and data collection
- Graphical and numerical summaries, scaling
- Frequency distributions
- Measures (different types of means, variance, standard deviation)
- Grouped data
- Covariance, correlation
- Linear regression, quality of the regression

Probability:

- Random phenomena (probability experiments and events)
- Probability rules
- Conditional probabilities (Bayes-Theorem)
- Random variables (discrete and continuous)
- Expected value und variance
- Discrete and continuous probability distributions

Inferential statistics:

- Point estimates, interval estimates, confidence intervals
- Hypothesis tests
- Statistical software skills: Using R

Teaching methods

Tuition in seminars, lectures and practical classes. The importance of statistical concepts is supported by including several relevant applied examples.

Entry requirements

Successful completion of the module “ML_1.05 Analysis and Discrete Mathematics” is recomended

Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs) Same module in "Communication and Information Engineering" and "Mobility and Logistics"
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Agatha Kalhoff
Additional information Reading: Peter Dalgaard: Introductory Statistics with R, 2nd edition, Springer, 2008 Johnson, R. R. / Kuby, P. J. (2008): Elementary Statistics. 10th edition. Belmont: Thomson Brooks/Cole Prem S. Mann: Introductory Statistics, 7th edition, John Wiley & Sons, 2011 Sullivan, M. (2011). Fundamentals of Statistics. 3rd edition. Boston: Pearson Prentice-Hall

ML_2.04 Object Oriented Programming

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_2.04	150 h	5 CP	2nd Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 45 h / 4 SWS	67.5 h / 6 SWS	82.5 h	Lecture: 45 students Exercise: 20 students

Learning outcomes / Competences and qualifications profile

The course has taught students to code in an object-oriented paradigm using a programming language like Java. Students know about classes, objects and methods. Successful students have a sound understanding of the principles and practice of object-oriented design using UML software tools in connection with OOP implementation. They are able to code, compile, test and run programs. After the course students are also able to analyze basic algorithms (e.g. for searching and sorting) and determine their complexity. Programming principles like iteration and recursion are well known including the use of simple data structures like arrays and matrices. Students are able to make use of members of classes found in the standard API (such as the Math class) and interfaces to extrenal data source like databases (JDBC).

Content

- Introduction: Compiler, Interpreter, IDE
- Principle elements: Variables, Statements, Operators, Flow Control
- Primitive Data Types, Reference Data Types, Strings and Arrays
- Principles of OOP such as Classes, Instances and Methods
- Generic Classes
- Exception Handling, Debugging
- Recursion, Complexity
- Structure charts, UML class diagrams

Teaching methods

Tuition in seminars, lectures and practical classes.

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Michael Schwind
Additional information Literature: Liang, Y.D.: Introduction to Java programming. ISBN 978-0-13-247275-3, 10th edition, Pearson, Boston, 2015 Sierra, K.; Bates, B.:“Head first Java“. ISBN 0-596-00920-8, O’Reilly, Beijing, 2005 Lafore, R.:Data structures and algorithms in Java. ISBN 0-672-32453-9, Sams Ind., Indianapolis, 2010

ML_2.05 Linear Algebra and Graph Theory

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_2.05	150 h	5 CP	2nd Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	Lecture: open Exercise: 30 students

Learning outcomes / Competences and qualifications profile

This lecture has introduced students to mathematical methods of linear algebra and the basics of graph theory which are needed to solve technical and operational problems.

With these mathematical methods and procedures at hand, students are able to solve linear problems and to apply the knowledge to their professional context as analysts, planners or engineers.

Additionally, students are able to develop advanced solutions to describe and optimize networks by applying the basic rules and procedures of graph theory.

Content

Linear Algebra:

- Introduction of vectors, matrices and matrix operations
- Vectors spaces and vector subspaces
- Linear equation systems
- Methods to solve linear equation systems**:** Gaussian Algorithm, Determinants, Inverse matrix
- Eigenvalues and Eigenspaces

Graph Theory:

- Fundamentals of graph theory
- Euler cycles, Hamilton cycles, weighted graphs
- Applications: Traveling Salesman, Postman Problem, Shortest path problem
- Algorithms of Fleury and Dijkstra

Teaching methods

Tuition in lectures and practical classes

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points Passed examination
Use of module (in other study programs) Same module in "Communication and Information Engineering" and "Mobility and Logistics"
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Agatha Kalhoff
Additional information Literature: Reinhard Diestel: Graph Theory, Springer 2017 Belkacem Said-Houari: Linear Algebra, Birkhäuser-Basel, 2017 Seymour Lipschutz 3,000 Solved Problems in Linear Algebra (Schaum's Solved Problems Series) Gerald Teschl, Susanne Teschl: Mathematik für Informatiker, Bd. 1 Diskrete Mathematik und Lineare Algebra, 3. Auflage, Springer 2009

ML_2.06 Project Management

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_2.06	150 h	5 CP	2nd Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Seminaristic lecture: 45 h / 4 semester hours per week (SWS)	45 h / 4 SWS	105 h	Seminaristic lecture: 40 students

Learning outcomes / Competences and qualifications profile

Having passed this module students are able to plan and carry out projects. They are familiar with methodological tools used in project planning, realisation, monitoring and completion in fields like personnel, costs, deadlines and quality. They are able to present project results appropriately.

Students have experienced the dynamics and pitfalls of teamwork and are sensitised for different cultures and the cooperation with people from different cultural background.

Content

- Defining the goals, procedures and phases of a project and its scope
- Developing the project plan (defining work packages, setting milestones, developing flow charts and network plans)
- Scheduling the project
- Creating, leading, and managing a project team (esp. teams with participants from different nations/cultures)
- Managing resources and monitoring project performance
- Controlling the project and managing risk
- International projects, cooperation with customers/project partners from foreign countries and different cultures (intercultural competences)
- Project closure, documentation and presenting to an audience
- Developing the presentation (developing the material, structuring the presentation, use of presentation software, preparation)
- Presentation techniques and visual aids

Teaching methods

Lectures, accompanied by exercises in which students conduct their own projects (case studies) and present their results

Entry requirements

None

Types of assessment

Certificate (Testat) – Project Work

Requirements for the award of credit points Participation in a project (case study), final presentation and reports
Use of module (in other study programs) Same module in "Communication and Information Engineering", "Environment and Energy", "International Business Administration", and "Mobility and Logistics"
Weight towards final grade None (ungraded)
Person in charge of module Prof. Dr. Dirk Bruckmann
Additional information The course can be replaced by another key competencies course (e.g. language course) in agreement with the Head of the examination board. Literature: Heerkens, G. R. (2002): Project Management. New York: McGraw-Hill. Hillson, D. (2009): Managing Risk in Projects. Farnham; Burlington: Gower. IPMA International Project Management Association (ed.) (2006) ICB-IPMA Competence Baseline, Version 3.0. Nijkerk. Larson, E. W. / Gray, C. F. (2011): Project Management. The Managerial Process. 5th edition. New York: McGraw-Hill. Raynolds, G. (2008): Presentation Zen. Simple Ideas on Presentation Design and Delivery. Berkeley: New Riders. Stanton, N. (2009): Mastering Communication. 5th edition. Basingstoke; New York: Palgrave Macmillian.

ML_3.01 Financial and Management Accounting

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_3.01	150 h	5 CP	3rd Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	Lecture: open Exercise: 40 students

Learning outcomes / Competences and qualifications profile

Students can name the different tasks of Financial and Management Accounting and explain why it has an important function in a company.

In Financial Accounting the students become able to perform simple and adjustment bookings as well as closing entries in double-entry bookkeeping in journal format and t-accounts. They can set up a trial balance and an income statement. Moreover, the students can explain the purposes of selected aspects of financial statements. They gain an insight into different reporting standards as well as financial ratios.

In Management Accounting the students learn to differentiate between strategic and operative tasks and explain their distinct focus. Regarding Operative Management Accounting, the students become familiar with the planning process of financial budgets. They are able to perform direct costing and apply it to questions such as production planning or make-or-buy decisions. Students can calculate and interpret different financial ratios, in order to evaluate a company's economic performance. Regarding Strategic Management Accounting, students are able to derive strategies from an organization`s vision, goals and objectives and to explain some key tools, such as Benchmarking and Balanced scorecard.

Content

- Financial and Management Accounting (Introduction)
- Bookkeeping (Basic terms in Financial Accounting, Components of financial statements, Double-entry system, Accounts and closing of accounts)
- Financial Statements (Elements of financial statements, Selected aspects of financial statements, e.g. different reporting standards or financial ratios)
- Management Accounting (Overview, Basic principles and categories, Organizational structuring of the Management Accounting function)
- Operative Management Accounting (Liquidity planning and present value, Direct costing and production planning and make-or-buy decisions)
- Strategic Management Accounting (Vision, goals and strategy, Planning process, Strategic Management Accounting tools, e.g. Benchmarking, Balanced scorecard, portfolio management)

Teaching methods

Lectures, accompanied by exercises in which qualitative and quantitative problems as well as case studies are solved and discussed.

Entry requirements None
Types of assessment Graded group work (50%) and graded oral examination (50%)
Requirements for the award of credit points Passed group work and passed oral examination
Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Anna Seidel
Additional information Reading: Bragg, S.M. (2011): Bookkeeping Essentials: Hoboken: Wiley & Sons. Dury, C. (2009): Management Accounting for Business. 4th edition. Andover: Cengage Learning EMEA. Kelly, J. / Barrow, P. / Epstein, L. (2011): Bookkeeping. 2nd edition. Chichester: Wiley & Sons. Weber, J. / Schäffer, U. (2008): Einführung in das Controlling. 12th edition. Stuttgart: Schäffer-Poeschel. Weber, J. / Weißenberger, B.E. (2010): Einführung in das Rechnungswesen. Bilanzierung und Kostenrechnung. 8th edition. Stuttgart: Schäffer-Poeschel.

ML_3.02 Production Logistics

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_3.02	150 h	5 CP	3rd Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

This module has introduced the main functions and tasks of production logistics.

The students are able to apply their knowledge to their professional context as production logistics engineers. They can develop and advance solutions to problems in the field of production logistics like demand forecasting, materials requirement plannings and calculation and/or production planning and scheduling.

They are also able to develop advanced solutions to optimize the material flow within the production areas, to minimize stocks in the buffers and to optimize machine utilization.

Content

- General design and functionality of production planning and control systems (PPC)
- Necessary master data for PPC and their structural architectures
- Basic procedures of demand forecasting and material requirement planning
- Static and dynamic forms of lotsize calculation and optimization
- Basic procedures of order scheduling and capacity planning (forward and backward planning)
- Main procedures of order releasing and production control (Kanban=pull principle, OPT=optimal scheduling, LOR=load oriented order release, cumulative quantity procedure, MRP II procedure)
- Key Performance Indicators of production logistics and characteristic KPI curves
- Basic laws of production logistics

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

It is strongly recommended to attend the following modules first:

"Fundamentals of Logistics" (1st semester)

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Andreas Schürholz
Additional information Literature Nyhuis, P.;Wiendahl, H.-P.: Fundamentals of Production Logistics: Theory, Tools and Applications; Springer Verlag Berlin 2008; ISBN: 978-3540342106 Chapman, St., N.: The Fundamentals of Production Planning and Control; Prentice Hall 2005; ISBN: 978-0130176158

ML_3.03 Decision Making Methods

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_3.03	150 h	5 CP	3rd Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Seminaristic lecture: 45 h / 4 semester hours per week (SWS)	45 h / 4 SWS	105 h	Seminaristic lecture: 40 students

Learning outcomes / Competences and qualifications profile

Successful students will be able to clearly define a problem and to find different appropriate solutions for it. They will have a good knowlegde of the methodologies needed to assess these solutions and to find the most suitable solution according to the current boundary conditions.

Content

- Defining of problems
- Finding of appropriate solutions
- Assessment techniques for the different solutions: Analytical Hierarchy Process, Event Trees, Cost-utility analysis, cost-benefit analysis, scoring models
- Specific models for the assessment of transport infrastructures

Teaching methods

Tuition in seminars and presentations

Entry requirements

None

Types of assessment

Certificate (Testat) – Term papers

Requirements for the award of credit points

Complete Assessment of a problem including the application of decision methods, presentation, and report.

Use of module (in other study programs)

Weight towards final grade

None (ungraded)

Person in charge of module

Prof. Dr. Dirk Bruckmann

Additional information

Literature:

Eisenführ, F., Weber, M. and Th. Langer (2010) Rational Decision Making, Springer, Berlin.

Forschungsgesellschaft für Straßen- und Verkehrswesen (ed.) (2018), Empfehlungen für Verkehrsplanungsprozesse EVP, FGSV-Verlag, Bergisch Gladbach.

Forschungsgesellschaft für Straßen- und Verkehrswesen (ed.) (1997), Empfehlungen für die Wirtschaftlichkeitsberechnungen für Straßen, FGSV-Verlag, Bergisch Gladbach.

I. Gilboa (2010) Rational Choice, MIT Press, Cambridge, Mass.

Th. L. Saaty (2001) Decision Making for Leaders – The Analytic Hierarchy Process for Decisions in a complex World, 3rd edition, RWS Publishing, Pittsburgh.

ML_3.04 Data Management

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_3.04	150 h	5 CP	3rd Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	45 students

Learning outcomes / Competences and qualifications profile

After passing this module students are able to make use of abstraction methods in order to transform real world scenarios into database models for various applications. The students are able to select the suitable architectural design for the given model. In addition to that students are familiar with normalization methods and data consitency principles. They can independently express SQL statements to solve complex tasks of database creation, use and maintance. Students have further knownledge about contemporary extensions of traditional database management, such as semantic web, ontologies, big data, data mining and NoSQL databases.

Content

- Introduction: file systems and data base systems, migration from file system, client-server-architecture, database-based web-applications
- Abstraction, analysis and modelling methods
- Data models, Entity Relationship Model (ERM), Enhanced Entity Relationship Model (primary key, foreign key, integrity constraints ...)
- Theoretical fundamentals of relational data bases: relational algebra, functional dependencies, normalization
- Structured Query Language
- Semantical modelling and data base design, Ontologies, Semantic Web, and other alternative non-centralized storage formats
- No-SQL Databases, Big Data
- Object oriented data bases, data warehouse, data mining, information
- retrieval, search engines

Teaching methods

Lectures and practical classes

Entry requirements

It is strongly recommended to attend the lecture "Fundamentals of Computer Science and Networks" before taking this course.

Types of assessment

Graded examination

Requirements for the award of credit points Passed examination
Use of module (in other study programs) Same module in "Communication and Information Engineering" and "Mobility and Logistics"
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Michael Schwind
Additional information Reading: Elmasri, R., Navathe S.: Database Systems, ISBN 0132144980, Pearson, 6th edition, 2014 Barnes, D.J., Kölling, M.: Objects First with Java - A Practical Introduction using BlueJ, Prentice Hall, 5th edition, 2012 Vaish, G.: Getting Started with NoSQL, Packt Publishing, 2013 Robinson, I., Webber, J., Eifrem E.: Graph Databases, O'Reilly, 2nd edition, 2015

ML_3.05 Linear Optimization and Operations Research

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_3.05	150 h	5 CP	3rd Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	Lecture: open Exercise: 30 students

Learning outcomes / Competences and qualifications profile

Successful students are able to classify real world optimisation problems and to identify methods for solving. They can translate real world problems into a mathematical optimisation model.

Starting from appropriate and comprehensive initial mathematical formulation for a subset of problem types students are able to solve these by using specific algorithms and software products (e.g. Excel Solver).

Students also have learned to interpret the results and to perform sensitivity analyses to assess the optimal solution and its stability. This allows them to suggest business decisions leading to effective improvements.

Content

- Introduction and discussion of optimisation in business administration and logistics
- Optimized allocation of scarce resources
- Classification of optimisation problems
- Linear programming (LP) and classes of LP problems
- Graphical solution of 2D decision problems
- Simplex algorithm and its interpretation
- Sensitivity analysis: shadow prices, reduced costs, stability of solution
- Integer programming (Cutting Plane Method, Set Covering)
- Non-linear optimization (Substitution, Lagrange and Golden Section search)
- Multi-objective optimization, Pareto-Optimality

Teaching methods

Lectures and practical classes

Entry requirements

Successful completion of the modules “ML_1.05 Analysis and Discrete Mathematics” and “ML_2.05 Linear Algebra and Graph Theory” is strongly recommended.

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs) Same module in "Communication and Information Engineering" and "Mobility and Logistics"
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Agatha Kalhoff
Additional information Reading: H.A. Eiselt, C.-L. Dandblom: Operations Research – A model-Based approach, Springer 2010 Leo Liberti: Problems and exercises in Operations Research, ´Ecole Polytechnique, 2010 Pablo Pedregal: Introduction to Optimization, Springer, 2004 Winston, Wayne L..: Operations research - applications and algorithms; 4. internat. student ed.; Thomson, Brooks/Cole 2008; ISBN: 978-0-534-42362-9

ML_3.06 Traffic Planning and Engineering

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_3.06	150 h	5 CP	3rd Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

The module will have introduced students to the basic systems and processes in planning and operations of private and public passenger transportation.

Students will have gained knowledge of the basic factor influencing travel demand, route choice and modal choice, and will know the basic principles of traffic flows, capacities and operational issues of road and rail transportation.

They will have learned about the basic methods and algorithms for routing, scheduling and network planning in private and public transportation.

Content

- The four-step model in traffic modelling (Demand estimation, Destination choice, Modal choice, Route assignment)
- Network design, Requirements for accessibility
- Basics of traffic operations (free lines)
- Road capacities and the fundamental diagram of traffic flows
- Scheduling in Public Transport

Teaching methods

Tuition in lectures and practical classes

Entry requirements

Students have to know the content of the module ML_2.03 Statistics.

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)

Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Dirk Bruckmann
Additional information Software: ptv VISUM Literature: Bundesministerium für Verkehr und digitale Infrastruktur (ed.) (2017) Verkehr in Zahlen 2016/17 FGSV (ed.) (2015) Handbuch für die Bemessung von Straßenverkehrsanlagen, Ausgabe 2015, FGSV-Verlag, Bergisch Gladbach. FGSV (ed.) (2010) Hinweise zur Schätzung des Verkehrsaufkommens von Gebietstypen, Ausgabe 2006, Korrektur, Stand Juni 2010, FGSV-Verlag, Bergisch Gladbach. FGSV (ed.) (2009) Richtlinien für integrierte Netzgestaltung RIN, Bergisch Gladbach. Kutz, Myer (ed.) (2011) Handbook of Transportation Engineering, Volume 1, Systems and Operation, 2nd edition, McGraw Hill, New York. Kutz, Myer (ed.) (2011) Handbook of Transportation Engineering, Volume 2, Applications and Technologies, 2nd edition, McGraw Hill, New York. Pachl, Jörn (2015) Railway Operation and Control, Third Edition, VTD Rail Publishing, Mountlake Terrace WA Reinhardt, Winfried (2011) Öffentlicher Personennahverkehr, Technik – rechtliche und betriebswirtschaftliche Grundlagen, Vieweg + Teubner, Wiesbaden. Schnabel, Werner, Lohse, Dieter (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung, Band 1, Straßenverkehrstechnik, Beuth Verlag, Berlin. Schnabel, Werner, Lohse, Dieter (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung, Band 2, Verkehrsplanung, Beuth Verlag, Berlin.

ML_4.01 Logistics and Traffic Infrastructures

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_4.01	150 h	5 CP	4th Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

The module will introduce Students to the design principles of logistics´sites and transport infrastructures.

Successful students will have gained knowledge of the basic design and construction principles of logistics sites like warehouses, distribution centers, crossdocking facilities and transshipment sites.

They will have learned the design principles of road and railways for open lines. This includes the required radius for curves as well as the design principle for horizontal and vertical gradients including the required clearances etc. They will have also learned about the design of road intersections and switches on railway lines.

Content

- Design principles for logistics sites
- Loading and Unloading facilities, Transhipment Sites
- Design of roads and railway lines (open line), including minimum radiuses for curves and transition curves, cross slopes, and banking
- Switches for railways
- Intersections for roads
- Pavements for logistics sites

Teaching methods

Tuition in lectures and practical classes

Entry requirements

The student needs to know the content of the module ML_3.06 Traffic Planning and Engineering.

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Dirk Bruckmann
Additional information Literature: FGSV (ed.) (2012) Richtlinien für den standardisierten Oberbau von Verkehrswegen, Ausgabe 2012, FGSV-Verlag, Bergisch Gladbach. FGSV (ed.) (2008) Richtlinie für die Anlage von Autobahnen, Ausgabe 2008, korrigiert 2014, FGSV-Verlag, Bergisch Gladbach. FGSV (ed.) (2013) Richtlinie für die Anlage von Landstraßen, Ausgabe 2012, FGSV-Verlag, Bergisch Gladbach. FGSV (ed.) (2009) Richtlinie für die Anlage von Stadtstraßen, Ausgabe 2009, korrigierter Nachdruck, FGSV-Verlag, Bergisch Gladbach. Garber, N. J. and L.A. Hoel (2015) Traffic and highway engineering, 5th edition, Cengage Learning, Stafford, Conn. Menius, R. and V. Matthews (2017) Bahnbau und Bahninfrastruktur, 9th edition, Springer Vieweg. Natzschka, H. (2011) Straßenbau, Entwurf und Bautechnik, 3rd edition, Vieweg+Teubner.

ML_4.02 Supply Chain Management

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_4.02	150 h	5 CP	4th Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

This module has introduced the main stuctures, functions and tasks of supply chain management (=SCM)

The students have gained a wide range of knowledge about the tasks and objectives of SCM. They have learned how to manage, describe (model) and plan (schedule) supply chains (=SC) and supply structures and are able to apply their knowledge to their professional context as a logistics and supply-chain managers.

They know how to design a SC network and are able to develop and advance solutions to problems in the fields of supply chains like demand forecasting in international SC networks, planning and managing inventories in SC or design transportation networks.

They are also able to develop advanced solutions for the optimization of material- and information flow within supply chains and to manage cross-functional drivers.

Content

- A strategic framework to analyze and describe supply chains including a process view (SCOR model),decision phases or optimization objectives
- Designing of a supply chain network like distribution networks, e-business applications or a global supply-chain network design
- Planning demand and supply in a supply chain including the demand forecasting, the aggregate planning or the sales and operations planning in a SC
- Managing inventories in a SC which includes forinstance the managing of uncertainty in a SC, the definition of safety inventory or determining the optimal level of product availability
- Designing and planning of transportation networks
- Managing cross-functional drivers in a SC, like sourcing decisions, pricing and revenue management or different information technologies

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

It ist strongly recommended to attend to the following lecture before:

"Production logistics" (3rd semester)

Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Andreas Schürholz
Additional information Literature Chopra, S.; Meindl, P.: Supply Chain Management: Strategy, planning and operation; 4th edition; Pearson 2010; ISBN: 978-0-13-609451-7 Stadtler, H.; Kilger, C.: Supply Chain Management and advanced planning; 4th edition; Springer 2008; ISBN 978-3-540-74511-2 Scott, C.; Lundgren, H.; Thompson, P.: Guide to Supply Chain Management; Springer 2011; ISBN 978-3-642-17675-3

ML_4.03 Identification & Automation

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_4.03	150 h	5 CP	4th Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	45 students

Learning outcomes / Competences and qualifications profile

Students have gained fundamental knowledge of devices and methods, which are used to automate logistical and other processes. The module enables students to be part of a team which designs logistical systems using technology to identify items, measure physical quantities and perform automatic reactions. The taught fundamentals enable students to discuss with suppliers of material flow systems or with suppliers of automated warehouse systems. Furthermore successful students are able to solve easy automating tasks independently.

Content

- Sample applications
- Identification systems:
  - Identification charcteristics
  - Optical charcter recognition
  - 1D barcodes
  - 2D codes
  - coding sementics (ILN, EAN,NVE, UPC,EPC)
  - Error Correction
  - The technology of barcode reader
  - Printing processes
  - Radio Frequency Identification
- Automation
  - Control Theory and control systems (logic controls, state machines, workflow, control loop, feedback mechanism)
  - Hardware components
    - Sensors and actuators
    - Automation devices, Controlling devices
    - Programming systems used in the automation context
  - Communication (bus systems)
  - System diagnosis

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

It is strongly recommended to pass the following modules first:

“Fundamentals of Computer Science & Networks” “Technical fundamentals” It is expected that students have knowledge of the principle components of a programming language .
Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Christian Ressel
Additional information Literature: te Hompel, M. et al. “Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems (Intralogistik) ”, ISBN 978-3540352181, Springer, 2008 Nof, S.Y.: Springer Handbook of Automation. ISBN 3540788301, Berlin, Springer, 2009. Pearce,S.; Bushnell,R.D.: The Bar Code Implementation Guide: Using Bar Codes in Distribution. ISBN 0941668061,Tower Hill Pr, 2010. Finkenzeller, K.: RFID Handbook. ISBN 0470695064, Chichester, Wiley, 2010 Bolton,W.: “Programmable logic controllers” (4th edition), ISBN 978-0-582-32773-3, Prentice Hall, 1998. Fraden J.: Handbook of modern sensors. ISBN 1441964657, New York, Springer, 2010.

ML_4.04 Business Information Systems

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_4.04	150 h	5 CP	4th Semester	Summer semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Seminaristic lecture: 45 h / 4 semester hours per week (SWS)	45 h / 4 SWS	105 h	40 students

Learning outcomes / Competences and qualifications profile

The students are familiar with the basic content of the domain Information Systems including Enterprise Ressource Planning, Customer Relationship Management, Logistics Planning Systems, etc. They also know about principles of Business Intelligence and its realization using heuristics and other optimization methods. Students also have learnt how to analyze and model a Business Processes. They know about the interconnection of IT infrastructure, electronic data processing and structure of a business organization and how Business Process Reengineering affects these companies. From the practical point of view, they are able to assess which class of software is best to solve a particular problem. As a result of practical training students know how to use some of the relevant software products on an introductory level, including ERP systems like SAP or Microsoft Dynamics and their prerequisite on the side of Business Process Modelling (e.g. ARIS).

Content

- Types of business-related information systems and their function in the enterprise.
- Business divisions, internal and external use of business intelligence to improve business processes
- Business process modelling Languages (e.g. BPMN) and their application
- Business processes and enterprise resources management (ERP) software
- Principles of E-commerce and the role of social networks in business planning

Teaching methods

Dialog oriented, seminaristic lectures with exercises

Practical training with application specific software

Students´ presentations

Entry requirements

None

Types of assessment

Certificate (Testat)

Requirements for the award of credit points

Passing specific assignments

Use of module (in other study programs) Same module in "International Business Administration" and "Mobility and Logistics"
Weight towards final grade None (ungraded)
Person in charge of module Prof. Dr. Michael Schwind
Additional information The course can be replaced by another key competencies course in agreement with the Head of the examination board. Software: ARIS from Software AG (Business Process Modelling), Microsoft Dynamics NAV, SAP (ERP Software) Reading: Laudon K.C., Laudon J.P., Management of Information Systems, Pearson, Boston, 2014 Seidelmeier, H.: Prozessmodellierung mit ARIS: Eine beispielorientierte Einführung für Studium und Praxis in ARIS 9, Springer, 4. Auflage, 2015

ML_5.01 Freight Logistics

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_5.01	150 h	5 CP	5th Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

Successful students will have gained basic knowledge of planning, operations and vehicles of all modes of freight transportation.

They will be able to find and to apply statistical data about freight transportation and to apply basic methods of demand forecasting and demand modelling for freight transportation.

They will also have an in-deepth knowledge about cost-structures and business models for different modes of transportation.

Content

- Freight statistics and demand forecasts
- Road freight: Planning, operations, vehicles
- Rail freight: Planning, operations, vehicles - Switches for railways
- Inland Waterway and maritime freight transport
- Freight transport modelling

Teaching methods

Tuition in lectures and practical classes

Entry requirements

Students needs to know the content of the modules ML_3.06 Traffic Planning and Engineering

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)

Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Dirk Bruckmann
Additional information Literature: Berndt, Thomas (2001) Eisenbahngüterverkehr, 1. Auflage, B.G. Teubner, Stuttgart/Leipzig/Wiesbaden. Bundesministerium für Verkehr und digitale Infrastruktur (ed.) (2017) Verkehr in Zahlen 2016/17 Clausen, U. and C. Geiger (2013) Verkehrs- und Transportlogistik, VDI-Buch, Springer-Verlag, Berlin, Heidelberg. Schnabel, Werner, Lohse, Dieter (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung, Band 2, Verkehrsplanung, Beuth Verlag, Berlin. Tavasszy, L. and G. De Jong (2014) Modelling Freight Transport, Elsevier.

ML_5.02 Legal requirements and international regulations

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_5.02	150 h	5 CP	5th Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

This module has given an overview of German and international legal requirements, laws, customs and international regulations.

The successful student has a sound knowledge of the main contents and requirements of legal requirements and international regulations, and is able to implement and perform international crossborder freights and transports. He has been introduced to the main legal parts of contracts with logistic providers, and has learned to setup and perform a secure supply chain. He has also gained a good knowledge of the tasks and responsibilities of an AEO (Authorized Economic Operator). Additionally, students should know basic consumer rights in international mobility.

The students can apply their knowledge to their professional context as internationally acting logistics managers.

Content

- Economic background of legal regulations: globalization and free trade zones
- Different forms and main contents of national and international freight and logistic contracts
- Rights and obligations of a freight forwarder and logistic service providerFreight law regulations in accordance with the German Commercial Code (HGB) and the General Terms and Conditions of the German Forwarding Trade (ADSp)
- European and International Transportation Conventions
- Liability of logistics providers, regulations and limits of liability in terms of SDR (Special Drawing Rights)
- Different forms and main contents of forwarding documents like freight contracts, way bill, certificates of delivery
- Current customs regulations for a secure supply chain
- Tasks and responsibilities of an AEO (Authorized Economic Operator)
- Standards and international regulations like CTPAT (Customs Trade Partnerschip against Terrorism)
- Consumer rights in international mobility

Teaching methods

Tuition in lectures and practical classes

Entry requirements

None

Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs)
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Michael Schwind
Additional information

ML_5.03 Interdisciplinary Project

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_5.03	300 h	10 CP	5th Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Project	67.5 h / 6 semester hours per week (SWS)	232.5 h	25 students

Learning outcomes / Competences and qualifications profile

In this module students have expanded and deepened the knowledge and skills they have acquired in previous project and modules. The interdisciplinary character of the project encourages students to discover new topics and gather practical experiences in different fields. Having completed this module, students are able to work on questions of theory or praxis in an international and interdisciplinary team. They are able to work scientifically and produce convincing results in their teams.

Content

The content differs between projects, depending on the study programs which are involved and the teaching staff's background. Depending on students' knowledge, lectures and workshops concerning different topics will be included so that students can attend different lectures of other study programms.

Teaching methods

Sessions for basic information about the project options; project coordination; project counseling provided by teaching staff or project partner from a company; accompanying lectures depending on projects' topics and demand; presentation of results to an interested audience consisting of university staff and students as well as external project partners.

Entry requirements

None

Types of assessment

Graded examination (depending on topic e.g. project report as well as presentation of results performed in team work.)

Requirements for the award of credit points

Project report and presentation of results delivered. Both have to meet quality criteria to pass the module.

Use of module (in other study programs)

Same module for all Bachelor study programs of the faculty

Weight towards final grade 3.45%
Person in charge of module All professors of the faculty
Additional information

ML_5.01 Internship / Semester abroad

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_6.01	900 h	30 CP	6th Semester	Summer or Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
		900 h	Open

Learning outcomes / Competences and qualifications profile

The internship module has enabled students to apply their knowledge in a practical setting. Students have gained insights into a company and into specific practical fields. During their stays as interns they have worked on different tasks in the companies and have taken on responsibility for certain topics.

Students having opted for a semester abroad have gained intercultural competencies. They have improved their foreign lanuage skills or have even studied a new foreign language, have learned how to get along in a foreign educational system and have worked with other students and teaching staff of different nationalities.

Content

Depending on internship company or university abroad. Topics will be discussed beforehand with teaching staff of Rhine-Waal University of Applied Sciences.

Teaching methods

Entry requirements

89 credit points achieved

Types of assessment

Certificate (Testat) –

Requirements for the award of credit points

20 weeks of internship have to be completed. Splitting these 20 weeks into parts is not possible. An internship report and and a presentation which have to meet quality criteria have to be delivered.

In case of a semester abroad at least 15 ECTS have to be earned at the foreign university which is based in a non-German speaking country and a semester report are required. Exceptions can be made in cases in which the success of the semester abroad is defined in a different way.

Use of module (in other study programs)

Same module in "Communication and Information Engineering", "Environment and Energy", "International Business Administration", and "Mobility and Logistics"

Weight towards final grade None (ungraded)
Person in charge of module All professors of the faculty
Additional information

ML_7.01 Workshop 1: Research Methods

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_7.01	150 h	5 CP	7th Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Seminaristic lecture: 45 h / 4 semester hours per week (SWS)	45 h / 4 SWS	105 h	50 students

Learning outcomes / Competences and qualifications profile

Having completed this course, students are able to decide which research method is suitable to answer the research question they have chosen for their thesis. Regarding the specific requirements of scientific work students gain the competence to develop a hypothesis, to use an appropriate study setup for the verification or falsification of the hypothesis, to collect and evaluate data, to consider data quality, to discuss own work in the context of other findings and to present results in articles and contributions to conferences.

Content

Lectures and exercises on

- the challenge of finding the appropriate research question
- observational versus experimental methods
- objectivity and repeatability
- hypotheses and theories
- correlation versus causality
- the experimental setup suitable to verify or falsify a hypothesis
- evaluation of nominal, ordinal, interval and ratio data
- descriptive statistics, algorithms and models
- presentation of data in tables and figures
- developing and validating models
- writing an extended abstract
- oral presentations at conferences
- the sources of information (scientific papers, norms, legislation)

Teaching methods

Seminaristic lectures which will include discussions as well as student tasks.

Entry requirements

175 credits points achieved (including internship or semester abroad)

Types of assessment

Certificate (Testat)

Requirements for the award of credit points

Successful participation reflected by the total of submitted assignments

Use of module (in other study programs) The module is open to students of other Bachelor courses of the Communication and Environment Faculty.
Weight towards final grade None (ungraded)
Person in charge of module Prof. Dr. Ute Hansen
Additional information Reading: Field, A., Hole, G. (2003): How to Design and Report Experiments, SAGE Publications Sullivan, M. (2014) Fundamentals of Statistics, Pearson

ML_7.02 Workshop 2: Scientific Writing

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_7.02	150 h	5 CP	7th Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Seminaristic lecture: 45 h / 4 semester hours per week (SWS)	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

Students are able to communicate their results of scientific working in an appropriate written form. They have learned how to write effectively, concisely, and clearly. By practicing the discussed writing techniques they have gained an understanding of and experience in creating a scientific manuscript.

Content

- Writing style
- Writing techniques
- Structure, outline, and first draft
- Organizing the writing process
- How to present methods and results effectively
- Discussing the results
- Putting the fragements together
- Abstract and Introduction
- Rewriting the manuscript
- Editing and publishing the text

Teaching methods

Workshop including seminaristic lectures and many writing exercises. Students discuss their results and support each other.

Entry requirements

175 credits points achieved (including internship or semester abroad)

Types of assessment

Certificate (Testat)

Requirements for the award of credit points

Successful participation reflected by the total of submitted assignments

Use of module (in other study programs)

Same module in "Communication and Information Engineering", "Environment and Energy", "International Business Administration", "Media Communication and Computer Sciences", and "Mobility and Logistics"

Weight towards final grade None (ungraded)
Person in charge of module Prof. Dr. Kai Tiedemann
Additional information Reading: Cargill, M. / O'Connor, P. (2009): Writing Scientific Research Articles. Strategy and Steps. Chichester: Wiley-Blackwell. Glasman-Deal, H. (2010): Science Research Writing for Non-Native Speakers of English. A Guide for Non-Native Speakers of English. London: Imperial College Press. Hofmann, A. H. (2010): Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford: Oxford University Press. Russey, W. E. / Ebel, H. F. / Bliefert, C. (2006): How to Write a Successful Science Thesis. The Concise Guide for Students. Weinheim: Wiley-VCH.

ML_7.03 Workshop 3: Advanced Seminar

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_7.03	150 h	5 CP	7th Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Seminaristic lecture: 45 h / 4 semester hours per week (SWS)	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

Students have received feedback, advice and guidance for their bachelor thesis. Each student has presented his or her own thesis in a short presentation (20-30 minutes). Together with other students, he/she has discussed the current state of research findings, methodology etc. In that way students have learned to present their research in a convincing way, to professionally defend their research and to accept feedback or criticism from their peers. At the same time students have learned to give feedback, provide ideas and advice for the work of others and formulate criticism in a fair way.

Content

- How to present research findings in a professional way
- How to comment and criticize the research of others
- How to moderate a group discussion
- Students' presentations of their own findings followed by an open group discussion

Teaching methods

Students present their own research. Group discussions about the findings and methods applied.

Entry requirements

175 credits points achieved (including internship or semester abroad)

Types of assessment

Certificate (Testat) – Presentation + Discussion

Requirements for the award of credit points

Individual student's presentation of his/her own research findings.

Use of module (in other study programs)

Same module in "Communication and Information Engineering", "Environment and Energy", "International Business Administration", and "Mobility and Logistics"

Weight towards final grade

None (ungraded)

Person in charge of module All professors of the faculty
Additional information

ML_7.04 Bachelor Thesis and Disputation

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_7.03	450 h	15 CP	7th Semester	Winter semester	1 semester

Courses	Teaching time	Self-study	Planned group size
Bachelor Thesis: 12 CP Disputation: 3 CP	Depends on need and demand		

Learning outcomes / Competences and qualifications profile

Students have conducted their own studies examining a research question from their scientific discipline, developing an appropriate methodological approach, and reflecting their research design and findings critically.

During the disputation students have proven their competencies in evaluating the topic and reflecting on its impact on real-life problems.

Content

- Depends on the topic; inter alia:
- Researching and evaluating literature
- Developing a research question and deriving hypotheses
- Operationalizing constructs
- Analyzing methodological strengths and weaknesses of different research approaches
- Developing research designs
- Conducting the studies
- Evaluating the results / Implementation
- Writing the thesis
- Presenting and defending the findings

Teaching methods

Individual supervision and support

Entry requirements

175 credits points achieved (including internship or semester abroad)

Types of assessment

Written Bachelor thesis and oral disputation

Requirements for the award of credit points

Individual student's presentation of his/her own research findings.

Use of module (in other study programs)

Weight towards final grade 10.35%
Person in charge of module All professors of the faculty
Additional information

ML_W.01 Elective: Logistic Simulations

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.01	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	20 students

Learning outcomes / Competences and qualifications profile

This module has introduced the analysis and optimization of material flow systems with discrete event simulation.

The students can apply their knowledge to their professional context as logistics engineers and logistics planners.

They can develop advanced solutions to problems in the field of simulation based analyzing of material flows and of material flow plannings.

They are also able to develop advanced solutions with the help of discrete event simulation systems for the optimization of material flows within the intralogistics of warehouses, conveyor networks and production logistics.

Content

- An elementary simulation-by-hand exercise
- General definitions and procedures of discrete simulations
- Basic architecture of discrete event simulation systems
- Rules and guidelines for simulation studies (basic procedure of a study)
- Basics of control levels for material flow systems
- Introduction of a the discrete event simulation tool DOSIMIS-3
- Elementary modelling and simulation tasks with DOSIMIS-3
- Simulation based analysis and optimization of a given material flow- or production-system plan
- Basic definitions and features of the digital factory approach

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

Successful completion of the following modules:

- "Technical Material Flow Systems" (2nd semester)

- "Production Logistics" (3rd semester)

Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs) Open to students of other study programs
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Andreas Schürholz
Additional information Literature VDI Guideline 3633 Part 1-11:Simulation of systems in materials handling, logistics and production; Beuth Verlag Berlin 2010 VDI Guideline 4499: Part 1: Digital factory Fundamentals; Beuth Verlag Berlin 2008 DOSIMIS-3: Users manual; SimulationsDienstleistungsZentrum GmbH; Dortmund 2003

ML_W.02 Elective: Lean Management

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.02	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

This module has covered the main theory of lean management and lean logistics.

Students have acquired the skills to develop advanced solutions for the optimization of material flows within the production areas.

They are able to eliminate waste by minimizing stocks in the buffers or optimizing machine utilization.

They can also develop advanced solutions to optimize the value stream of goods and products by applying the methods of stream mapping and value stream design.

The successful student can apply his knowledge to the professional context of a logistics engineer or logistics planner especially in the fields of production logistics.

Content

- Overview of general focus, contents and history of lean management
- The 14 management principles of the Toyota production system
- The four basic lean principles and their implementation: flow principle, takt principle, pull principle and zero defect principle
- The 5S and the 6 Sigma approach
- Value stream mapping and desing
- Elements of lean logistics, like Kanban-loops, supermarkets, internal round-trips
- Methods for production and quality optimization, like SMED, Chaku-Chaku production, Poka-Yoke, Andon boards

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

It ist strongly recommended to attend to the following modules before taking this course:

- "Planning of logistic systems and processes" (2nd semester)

- "Production logistics" (3rd semester)

Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs) Open to students of other study programs
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Andreas Schürholz
Additional information Literature Liker, Jeffrey: The Toyota way; McGraw Hill New York 2004; ISBN 0-07-139231-9 Womack, J.P; Jones D. T.: Lean Thinking: Banish waste and create wealth in your company; Free Press 2003; ISBN: 978-0743249270 Gygi, Craig, et al.: Six Sigma for Dummies; Wiley Publishing Inc.; Indianapolis 2005; ISBN 0-7645-6798-5 Gygi, Craig, et al.: Six Sigma Workbook; Wiley Publishing Inc.; Indianapolis 2006; ISBN 978-0470045190

ML_W.03 Elective: Harbour and Airport Logistics

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.03	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	20 students

Learning outcomes / Competences and qualifications profile

This module has taught the basics of different structures, resources, processes and strategies of harbour and airport logistics.

The students have gained knowledge of the basics of different port (harbour, airport) structures, variants of processes and control strategies.

The students can apply their knowledge to their professional context as logistics engineers and logistics planners in the fields of traffic logistics and port logistics.

They can identify problems and know advanced solutions to problems in the fields of developing new and optimizing existing port structures and processes.

Content

The content is divided into two main parts: Harbour logistics and airport logistics

The main topics of harbour logistic are:

- Basics of maritime logistics: different types of ships, vessels, containers etc.
- Structures and processes of sea ports and domestic (inland) ports,
- Structures and processes of container terminals and of intermodal terminals
- Techniques, equipment and resources for charging and discharging of ships and vessels
- Basics of loading planning (storage plan)

The main topics of airport logistics are:

- Basics of air cargo logistics: different types of air-cargo planes, loading equipment, special containers (Unit Load Devices) and packagings for air cargo
- Baggage conveyor systems and processes in airports
- Passenger handling systems and processes
- Air-cargo-handling systems and processes
- Basics of airline network design and flight scheduling
- Airside operations: apron and runways, approach processes
- Internal infrastructure of the buildings, air traffic infra structure, airstrips for departure and arrivals
- Landside operations: External traffic connections to road and rail, businesses and facilities rail

Teaching methods

Tuition in lectures, practical classes and visits of airports and harbours

Entry requirements

It is strongly recommended to attend to the following module before taking this course:

"Technical Logistic Systems" (2nd semester)

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)

Open to students of other study programs

Weight towards final grade

3.45%

Person in charge of module

Prof. Dr. Dirk Bruckmann

Additional information

Reading:

Bradley, A. (2010) The independent airport planning manual, Woodhead Publishing, Oxford.

De Neufville, R., Odoni, A., Belobaba, P., Reynolds, T. (2013) Airport Systems: Planning, Design, and Management, Second Edition, McGraw-Hill Education.

Goedeking, P. (2010) Networks in Aviation, Springer-Verlag, Berlin, Heidelberg

Mensen, H. (2013) Handbuch der Luftfahrt, 2nd edition, Springer Vieweg, Berlin, Heidelberg

Richter, A. (2013) Gepäcklogistik auf Flughäfen, Grundlagen, Systeme, Konzepte und Perspektiven, Springer Gabler, Berlin, Heidelberg, 2013.

Transportation Research Board (ed.) (2009) Airport Cooperative Research Program, ACRP, Airport Passenger Related Processing Rates, Guidebook, ACRP Report 23, Washington DC.

Transportation Research Board (ed.) (2010) Airport Cooperative Research Program, ACRP, Airport Passenger Terminal Planing and Design, ACRP Report 25, Washington DC.

Transportation Research Board (ed.)(2015) Airport Cooperative Research Program, ACRP, Guideline for Air Cargo Facility Planing and Development, ACRP Report 143, Washington DC.

ML_W.04 Elective: Procurement and Distribution Logistics

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.04	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	20 students

Learning outcomes / Competences and qualifications profile

This module has taught the basics of different structures, resources, processes and strategies in the fields of procurement logistics and distribution logistics. The students have learnt how this structure is integrated into existing enterprises in a holistic way. The connection of Inbound/Outbound Logistics with the entire functionality of a real enterprise has been explored together with insight to all other fundamental tasks and departments in a company. The students have learned basics about the different delivery structures, variants of processes and control strategies from the suppliers to the production (procurement) and from the production to the final customers (distribution) in connection with the corresponding economic background.

The students can apply their knowledge to their professional context as engineers of logistics networks and logistics planners. They can identify problems and know advanced solutions to problems in the fields of developing new and optimizing existing procurement and distribution processes and structures.

Content

The technical topics of procurement & distribution logistics are:

- Different procurement structures and strategies, like global-, single- or multiple sourcing, modular sourcing
- Different concepts of the external material procurement: production-synchronous procurement (JIT/JIS deliveries), direct delivery callofs
- Different techniques of supplier connections, pick-up- and supply processes, vendor managed inventory
- Determination of the warehouse locations (optimal warehouse location), Planning of logistics networks
- Customer-order to warehouse allocation strategies and optimization

The economic topics of procurement & distribution logistics are:

- Tendering and allocation methods for the procurement of logistics services
- Market types in procurement & distribution processes
- Topics of e-procurement: Web-portals, EDI solutions like e-kanban, advanced shipping notes (ASN) etc.

A practical part of the exercise is the participation in the simulative business game "Topsim Logistics"

Teaching methods

Tuition in lectures and practical classes

Entry requirements It is strongly recommended to attend to the following module before taking this course: "Production Logistics (3rd semester)"
Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs) Open to students of other study programs
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Michael Schwind
Additional information Reading: Rodrigue J.P., Comtois C., Slack B., The Geography of Transportation Systems, Routledge, NY, 2009 Benton W. C.: Purchasing and Supply Chain Management, McGraw Hill, NY, 2010 2nd editon, 2013 Isermann H., Logistik: Beschaffung, Produktion, Distribution, München, Oldenbourg, 1994

ML_W.05 Elective: Strategic Managment and Business Planning

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.05	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	Lecture: open Exercise: 40 students

Learning outcomes / Competences and qualifications profile

Students are acquainted with fundamental concepts and common tools of strategic management. They are able to analyse the positioning of an organization, to develop strategic options, and they know how to transfer these options to stratigic programs.

Furthermore, students know how to apply this knowledge to the development of a new business. They have acquired skills of business planning and have first experience in writing a sound business plan.

Content

- The strategic management process
- Vision and mission
- Setting objectives
- Analyzing the external environment (macroenvironment and competitive environment)
- Analyzing the internal environment (competitive advantage, value chain analyzis, balanced scorecard)
- Corporate strategies
- Business strategies
- Strategies for multibusiness corporations
- Competing in international markets
- Strategy implementation and control
- Business planning: Defining and modeling the business
- Structure of the business plan
- Addressing the target audience (style and layout of the business plan, presentation)

Teaching methods

Lectures, accompanied by exercises in which students develop their own business plan

Entry requirements

None

Types of assessment

Graded examination

Requirements for the award of credit points Passed examination
Use of module (in other study programs) Open to students of other study programs
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Dirk Bruckmann
Additional information Reading: Capezino, P. J. (2010): Manager's Guide to Business Planning. New York: McGraw-Hill. Dess, G. G., / Lumpkin, G. T., / Eisner, A. B. (2010): Strategic Management. Creating Competitive Advantage. 5th edition. New York: McGraw-Hill. Friend, G., / Zehle, S. (2009): Guide to Business Planning. London: Economist Profile Books. Gamble, J. E., / Thompson, A. A. (2011): Essentials of Strategic Management. The Quest for Competitive Advantage. 2nd edition. New York: McGraw-Hill. Johnson, G., Whittington, R., Scholes, K., Angwin, D., Regner, P. (2014) Exploring Strategy, Text and Cases, 10th edition, Peason, Harlow. Pearce, J. A., / Robinson, R. B. (2011): Strategic Management. Formulation, Implementation, and Control. 12th edition. New York: McGraw-Hill.

ML_W.06 Elective: Quality and Risk Management

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.06	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	40 students

Learning outcomes / Competences and qualifications profile

Students have become sensitive to risks and to deficiencies in quality. They are aware of business and legal requirements to conduct quality and risk management.

Furthermore, the students know the different steps of the risk management process. They are able to assess major risks and quality risks, and they know how to implement a risk management process.

Students also have learned the passive and active types of controlling risks and how to apply such methods.

Furthermore, they are aware of the needs for implementing an early warning system and know the limitations of managing quality and risk.

Content

- Why quality and risk management?
- Business requirements and legal guidelines
- The Risk Policy
- Risk categories, Risks in Logistics, Quality Risk Management
- Implementing risk management: identifying, analyzing, quantifying, controlling, and reporting risks
- Techniques of identifying risk: risk assessment, raising awareness, workshops
- Risk maps, the risk frontier
- Quantifying risks: data analysis, distributional approaches, simulation, aggregation and correlation of risks
- Controlling risks: active and passive control
- Early warning, emergency planning, cisis management
- Supply Chain Risk Management

Teaching methods

Lectures, accompanied by exercises in which case studies and problems in practice are presented.

Entry requirements

Successful completion of the modules “ML_2.03 Statistics” is strongly recommended.

Types of assessment

Graded individual report on a given case study.

Requirements for the award of credit points Passed report
Use of module (in other study programs) Open to students of other study programs
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Agatha Kalhoff
Additional information Reading: Enterprise Risk Management Models, Second Edition; David L. Olson, Desheng Dash Wu; Springer-Verlag GmbH Germany 2017 Risk Management Handbook: A Practical Guide to Managing the Multiple Dimensions of Risk, edited by David Hillson, Kogan Page Limited 2016 Risikoaggregation in der Praxis, Deutsche Gesellschaft für Risikomanagement e.V., Springer Verlag 2008 Die 55 größten Flops der Wirtschaftsgeschichte, Klaus Schmeh, Wirtschaftsverlag Carl Ueberreuter 2002

ML_W.07 Elective: Ambient Intelligent Systems

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.07	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	20 students

Learning outcomes / Competences and qualifications profile

Ambient Intelligence envisions a world where people are surrounded by sensors and intelligent, intuitive interfaces embedded in the everyday objects around them. This enables the environment to identify individuals or objects and to response to their presence and behaviour in an appropriate and perhaps personalized way.

In this module the students have been introduced to the vision of ambient intelligent systems. They have gained a sound understanding of enabling technologies and they got an overview of applications and experiments. The application field Ambient Assisted Living (AAL) has been discussed in detail. The students have learned how new technology can be used to improve care processes and to increase the personal mobility and comfort of elderly people. They also got a brief idea of other socio-cultural impacts. At the end of this course students are able to come up with new ideas and to start innovative projects in this area.

Content

- Vision, history and predecessor technologies/visions
- Working with the user: human centered design
- Describing Resources: XML(S), RDF(S), OWL
- Service Discovery
- Context: modelling, detection and recognition, fully observable vs partially observable environments
- Important algorithms
- Ideas and current research in the area of AmI and AAL

Teaching methods

Tuition in seminars, lectures and practical classes

Entry requirements

It is strongly recommended to attend the following lectures first before taking this course or in parallel:

CI_04, ML_1.04 "Fundamentals of Computer Science and Networks"

ML_4.03 “Identification and Automation”

Types of assessment Graded examination
Requirements for the award of credit points Passed examination
Use of module (in other study programs) Open to students of other study programs
Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Christian Ressel
Additional information Reading: Corchado,J.M. et al: 3rd Symposium of Ubiquitous Computing and Ambient Intelligence 2008. ISBN 978-3-540-85866-9, Berlin, Springer, 2008 Corchado,J.M. et al: Ambient Intelligence and Future Trends -: International Symposium on Ambient Intelligence 2010. ISBN 3642132677, Berlin, Springer 2010 Omatu, S. et al: Distributed Computing, Artificial Intelligence, Bioinformatics, Soft Computing, and Ambient Assisted Living: 10th International Work-Conference. ISBN 3642024807, Berlin, Springer, 2009 Verhaegh, W.; Aarts,E.; Korst,J.: Algorithms in ambient intelligence. ISBN 978-1402017575,Springer Netherlands, 2004. Bravo, J. et al: Ambient Assisted Living: Third International Workshop, IWAAL 2011. ISBN 3642213022, Berlin, Springer, 2011. Vasilakos,A.; Pedrycz, W.: Ambient intelligence, wireless networking, and ubiquitous computing. ISBN 1-580-53963-7,Boston, Artech House Inc, 2006 Russell, S. & Norvig, P. Artificial Intelligence - A Modern Approach,ISBN 978-0-13-604259-4, New Jersey, Pearson Educatiuon Inc., 2010

ML_W.08 Elective: Geoinformation Systems

Code	Workload	Credits	Level of module	Frequency of offer	Duration
ML_W.08	150 h	5 CP	4th or 5th Semester	Once a year	1 semester

Courses	Teaching time	Self-study	Planned group size
Lecture: 22.5 h / 2 semester hours per week (SWS) Exercise: 22.5 h / 2 SWS	45 h / 4 SWS	105 h	35 students

Learning outcomes / Competences and qualifications profile

The successful students will have gained basic knowledge about geographic coordinative systems and different formats of geographic coordinates.

The students will have achieved basic knowledge about different positioning technologies.

The students will be able to geo-reference data from different sources and to analyze these data.

The students will be able to use geo-referenced data to create maps and other illustrations.

Content

- Geographical coordinate System
- Positioning systems
- Generation and management of geographical data
- Visualization of geographical data

Teaching methods

Tuition in lectures and practical classes

Entry requirements

The student needs to know the content of the modules ML_3.06 Traffic Planning and Engineering

Types of assessment

Graded examination

Requirements for the award of credit points

Passed examination

Use of module (in other study programs)

Open to students of other study programs

Weight towards final grade 3.45%
Person in charge of module Prof. Dr. Dirk Bruckmann
Additional information Literature: Berndt, Thomas (2001) Eisenbahngüterverkehr, 1. Auflage, B.G. Teubner, Stuttgart/Leipzig/Wiesbaden. Bundesministerium für Verkehr und digitale Infrastruktur (ed.) (2017) Verkehr in Zahlen 2016/17