TUHH
Hamburg
University of
Technology

# Module Manual

Bachelor of Science (B.Sc.)

# Logistics and Mobility

Cohort: Winter Term 2020

Updated: 12th August 2022

# Table of Contents


Table of Contents 2
Program description 3
Core Qualification 4
Module M0829: Foundations of Management 4
Module M0850: Mathematics I 7
Module M0889: Mechanics I (Statics) 10
Module M0577: Non-technical Courses for Bachelors 12
Module M0650: Introduction to Logistics and Mobility 14
Module M1004: Logistics Management 17
Module M0851: Mathematics II 20
Module M1261: Management 23
Module M0696: Mechanics II: Mechanics of Materials 24
Module M1286: Technical Logistics 26
Module M0887: Transportation Planning and Traffic Engineering 28
Module M1319: Selected Problems of Management 30
Module M1295: Business Issues in Logistics 32
Module M0608: Basics of Electrical Engineering 33
Module M1082: Mathematics III - Differential Equations I 35
Module M1013: Traffic systems and handling technology 37
Module M0987: Legal Foundations of Transportation and Logistics 39
Module M1704: Gamification of Strategic Thinking 40
Module M0622: Business Administration and Enterprise Resource Planning: CERMEDES AG 41
Module M0831: Introduction to Operations Research and Statistics 43
Module M1073: Complementary Courses in Business Administration 46
Module M0594: Fundamentals of Mechanical Engineering Design 52
Module M0986: Introduction to Transportation Economics 54
Module M1693: Computer Science for Engineers - Programming Concepts, Data Handling & Communication 55
Module M0974: Business Simulation Marktstrat 57
Module M0681: Project Course Logistics and Mobility 59
Specialization Engineering Science 60
Module M0725: Production Engineering 60
Module M0575: Procedural Programming 63
Module M0833: Introduction to Control Systems 65
Module M0933: Fundamentals of Materials Science 67
Module M0610: Electrical Machines and Actuators 69
Module M0865: Fundamentals of Production and Quality Management 71
Module M0852: Graph Theory and Optimization 73
Module M0553: Objectoriented Programming, Algorithms and Data Structures 75
Module M0727: Stochastics 76
Specialization Logistics and Mobility 78
Module M1014: Logistics Service Provider Management 78
Module M0983: Mobility Concepts 80
Module M1290: Simulation of intra logistics 82
Module M1112: Production Logistics 84
Module M1289: Logistical systems - Industry 4.0 85
Module M1349: Object-oriented programming in logistics 87
Module M1070: Simulation of Transport and Handling Systems 89
Module M0985: Introduction to Railways 91
Module M0980: Logistics, Transport and Environment 93
Module M0767: Aeronautical Systems 95
Thesis 97
Module M-001: Bachelor Thesis 97

# Program description

## Content

Economic development with its swift changes in products and processes has led to a considerable transformation of inter-company division of labor. Today, cross-enterprise supply chains in which complex production processes must be planned, shaped, and controlled characterize this division of labor. Transportation, transshipment, and storage play a decisive role in this process.

Conducting business successfully under these framework conditions is made possible by the interaction of innovative technical systems, information and communication technologies, and management strategies. That is why the study program for a BSc in Logistics and Mobility, which prepares students for this area of business is focused on an extensive interdisciplinary basic knowledge of science, engineering, and business management. In the course of their studies students learn how to deal with issues arising from logistics and transport planning.

## Career prospects

Graduates can embark directly on a career in logistics or transport planning. The study program prepares them for independent and collaborative work and for work in positions of responsibility.

Possible employers include logistics industry enterprises, manufacturing industry and commerce, engineering and planning firms, transport companies, construction companies, infrastructure management and the public sector (especially in transport planning).

At the Hamburg University of Technology Graduates can follow on from their BSc in Logistics and Mobility and study among others for a MSc in "Logistics, Infrastructure, and Mobility" or a MSc in "International Management and Engineering".

## Learning target

The acquired competences enable graduates to analyze, shape, and control logistics and transportation systems by means of their wide-ranging, in-depth technical and management expertise and the methods they have learnt. Integrated and analytic thinking enables them to make sense of and optimize connected processes. Graduates are able to plan and control the flow systems - of goods, people, information, and money - that are needed for manufacturing goods and providing services and to apply their theoretical knowledge to practical issues. Due to the program’s alignment to basics of engineering and business management graduates are able to solve technical problems, to devise new technical systems for logistics and transportation systems, and to evaluate them in economic terms.

Personal competences are another important part of the study program. Students are prepared by group assignments and project work to work their way into problems either individually or in teams and to solve them either on their own or in collaboration with other members of the team. On completion of their studies they are able to formulate their findings precisely in writing and to present them in an appropriate manner to an (expert) audience. Graduates are able to apply methods of scientific work reliably and are thus qualified to work in research or to deepen their competences by studying for a second degree.

## Program structure

The study program is structured into the "core qualification", the "Specialisation Engineering Science", the "Specialisation Logistics and Mobility" and the Thesis.

In the core qualification students are tought the basics of mathematics, engineering science, business administration and logistics and mobility. The core qualification is completed by nontechnical complementary courses and a project course in the fifth semester for preparing students for the bachelor thesis.

In the specialisation engineering science students have the possibility to chose two courses out of nine selectables for the fifth and sixth semester to deepen their knowledge in the respective technical field.

In the specialisation logistics and mobility students can chose four out of eight selectables of the fields of logistics and traffic planning to deepen their knowledge in the respective fields.

The bachelor thesis takes place in the sixth semester.

## Core Qualification

Students gain basic knowledge as well as deepend skills in mathematics and business administration.

### Module M0829: Foundations of Management

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Management Tutorial (L0882) | Recitation Section (small) | 2 | 3 |
| Introduction to Management (L0880) | Lecture | 3 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Christoph Ihl |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basic Knowledge of Mathematics and Business |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | After taking this module, students know the important basics of many different areas in Business and Management, from Planning and Organisation to Marketing and Innovation, and also to Investment and Controlling. In particular they are able to<br>• explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from the field of Management<br>• explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects<br>• describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and human ressource management, information management, innovation management and marketing<br>• explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and explain some basic methods from mathematical Finance<br>• state basics from accounting and costing and selected controlling methods. |
| *Skills* | Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out an Entrepreneurship project in a team. In particular, they are able to<br>• analyse Management goals and structure them appropriately<br>• analyse organisational and staff structures of companies<br>• apply methods for decision making under multiple objectives, under uncertainty and under risk<br>• analyse production and procurement systems and Business information systems<br>• analyse and apply basic methods of marketing<br>• select and apply basic methods from mathematical finance to predefined problems<br>• apply basic methods from accounting, costing and controlling to predefined problems |
| **Personal Competence** | |
| *Social Competence* | Students are able to<br>• work successfully in a team of students<br>• to apply their knowledge from the lecture to an entrepreneurship project and write a coherent report on the project<br>• to communicate appropriately and<br>• to cooperate respectfully with their fellow students. |
| *Autonomy* | Students are able to<br>• work in a team and to organize the team themselves<br>• to write a report on their project. |
| **Workload in Hours** | Independent Study Time 110, Study Time in Lecture 70 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Subject theoretical and practical work |
| **Examination duration and scale** | several written exams during the semester |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Core Qualification: Compulsory<br>Civil- and Environmental Engineering: Core Qualification: Compulsory<br>Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory<br>Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory<br>Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory<br>Bioprocess Engineering: Core Qualification: Compulsory<br>Computer Science: Core Qualification: Compulsory<br>Data Science: Core Qualification: Compulsory<br>Electrical Engineering: Core Qualification: Compulsory<br>Energy and Environmental Engineering: Core Qualification: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory |

| | |
|---|---|
| | General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory<br>Computational Science and Engineering: Core Qualification: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Orientierungsstudium: Core Qualification: Elective Compulsory<br>Naval Architecture: Core Qualification: Compulsory<br>Technomathematics: Core Qualification: Compulsory<br>Process Engineering: Core Qualification: Compulsory |

| **Course L0882: Management Tutorial** | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Christoph Ihl, Katharina Roedelius |
| **Language** | DE |
| **Cycle** | WiSe/SoSe |
| **Content** | In the management tutorial, the contents of the lecture will be deepened by practical examples and the application of the discussed tools.<br><br>If there is adequate demand, a problem-oriented tutorial will be offered in parallel, which students can choose alternatively. Here, students work in groups on se selected projects that focus on the elaboration of an innovative business idea from the point of view of an established company or a startup. Again, the busin knowledge from the lecture should come to practical use. The group projects are guided by a mentor. |
| **Literature** | Relevante Literatur aus der korrespondierenden Vorlesung. |

| Course L0880: Introduction to Management | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 3 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 48, Study Time in Lecture 42 |
| **Lecturer** | Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgang Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona |
| **Language** | DE |
| **Cycle** | WiSe/SoSe |
| **Content** | • Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management<br>• Important definitions from Management,<br>• Developing Objectives for Business, and their relation to important Business functions<br>• Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management, Marketing and Sales<br>Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management<br>• Definitions as information, information systems, aspects of data security and strategic information systems<br>• Definition and Relevance of innovations, e.g. innovation opporunities, risks etc.<br>• Relevance of marketing, B2B vs. B2C-Marketing<br>• different techniques from the field of marketing (e.g. scenario technique), pricing strategies<br>• important organizational structures<br>• basics of human ressource management<br>• Introduction to Business Planning and the steps of a planning process<br>• Decision Analysis: Elements of decision problems and methods for solving decision problems<br>• Selected Planning Tasks, e.g. Investment and Financial Decisions<br>• Introduction to Accounting: Accounting, Balance-Sheets, Costing<br>• Relevance of Controlling and selected Controlling methods<br>• Important aspects of Entrepreneurship projects |
| **Literature** | Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008<br><br>Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003<br><br>Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.<br><br>Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.<br><br>Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.<br><br>Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.<br><br>Weber, J., Schäffer, U. : Einführung in das Controlling, 12. Auflage, Stuttgart 2008.<br><br>Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006. |

## Module M0850: Mathematics I

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Analysis I (L1010) | Lecture | 2 | 2 |
| Analysis I (L1012) | Recitation Section (small) | 1 | 1 |
| Analysis I (L1013) | Recitation Section (large) | 1 | 1 |
| Linear Algebra I (L0912) | Lecture | 2 | 2 |
| Linear Algebra I (L0913) | Recitation Section (small) | 1 | 1 |
| Linear Algebra I (L0914) | Recitation Section (large) | 1 | 1 |

| | |
|---|---|
| **Module Responsible** | Prof. Anusch Taraz |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | School mathematics |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • Students can name the basic concepts in analysis and linear algebra. They are able to explain them using appropriate examples.<br>• Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples.<br>• They know proof strategies and can reproduce them. |
| *Skills* | • Students can model problems in analysis and linear algebra with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods.<br>• Students are able to discover and verify further logical connections between the concepts studied in the course.<br>• For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. |
| **Personal Competence** | |
| *Social Competence* | • Students are able to work together in teams. They are capable to use mathematics as a common language.<br>• In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers. |
| *Autonomy* | • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them.<br>• Students have developed sufficient persistence to be able to work for longer periods in a goal-oriented manner on hard problems. |
| **Workload in Hours** | Independent Study Time 128, Study Time in Lecture 112 |
| **Credit points** | 8 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 60 min (Analysis I) + 60 min (Linear Algebra I) |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Core Qualification: Compulsory<br>Civil- and Environmental Engineering: Core Qualification: Compulsory<br>Bioprocess Engineering: Core Qualification: Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Electrical Engineering: Core Qualification: Compulsory<br>Energy and Environmental Engineering: Core Qualification: Compulsory<br>Computational Science and Engineering: Core Qualification: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Orientierungsstudium: Core Qualification: Elective Compulsory<br>Naval Architecture: Core Qualification: Compulsory<br>Process Engineering: Core Qualification: Compulsory |

| Course L1010: Analysis I | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | Foundations of differential and integrational calculus of one variable<br>• statements, sets and functions<br>• natural and real numbers<br>• convergence of sequences and series<br>• continuous and differentiable functions<br>• mean value theorems<br>• Taylor series<br>• calculus<br>• error analysis<br>• fixpoint iteration |
| **Literature** | • http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html |

| Course L1012: Analysis I | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L1013: Analysis I | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L0912: Linear Algebra I | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Anusch Taraz, Prof. Marko Lindner |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • vectors: intuition, rules, inner and cross product, lines and planes<br>• systems of linear equations: Gauß elimination, matrix product, inverse matrices, transformations, block matrices, determinants<br>• orthogonal projection in R^n, Gram-Schmidt-Orthonormalization |
| **Literature** | • T. Arens u.a. : Mathematik, Spektrum Akademischer Verlag, Heidelberg 2009<br>• W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994<br>• W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994<br>• G. Strang: Lineare Algebra, Springer-Verlag, 2003<br>• G. und S. Teschl: Mathematik für Informatiker, Band 1, Springer-Verlag, 2013 |

| Course L0913: Linear Algebra I | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Anusch Taraz, Prof. Marko Lindner |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • vectors: intuition, rules, inner and cross product, lines and planes<br>• general vector spaces: subspaces, Euclidean vector spaces<br>• systems of linear equations: Gauß-elimination, matrix product, inverse matrices, transformations, LR-decomposition, block matrices, determinants |
| **Literature** | • T. Arens u.a. : Mathematik, Spektrum Akademischer Verlag, Heidelberg 2009<br>• W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994<br>• W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 |

| Course L0914: Linear Algebra I | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Dr. Christian Seifert, Dr. Dennis Clemens |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0889: Mechanics I (Statics)

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Mechanics I (Statics) (L1001) | Lecture | 2 | 3 |
| Mechanics I (Statics) (L1002) | Recitation Section (small) | 2 | 2 |
| Mechanics I (Statics) (L1003) | Recitation Section (large) | 1 | 1 |

| | |
|---|---|
| **Module Responsible** | Prof. Robert Seifried |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Solid school knowledge in mathematics and physics. |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students can<br>• describe the axiomatic procedure used in mechanical contexts;<br>• explain important steps in model design;<br>• present technical knowledge in stereostatics. |
| *Skills* | The students can<br>• explain the important elements of mathematical / mechanical analysis and model formation, and apply it to the context of their own problems;<br>• apply basic statical methods to engineering problems;<br>• estimate the reach and boundaries of statical methods and extend them to be applicable to wider problem sets. |
| **Personal Competence** | |
| *Social Competence* | The students can work in groups and support each other to overcome difficulties. |
| *Autonomy* | Students are capable of determining their own strengths and weaknesses and to organize their time and learning based on those. |
| **Workload in Hours** | Independent Study Time 110, Study Time in Lecture 70 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 90 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Core Qualification: Compulsory<br>Civil- and Environmental Engineering: Core Qualification: Compulsory<br>Data Science: Specialisation Mechanics: Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Orientierungsstudium: Core Qualification: Elective Compulsory<br>Naval Architecture: Core Qualification: Compulsory |

### Course L1001: Mechanics I (Statics)

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Robert Seifried |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • Tasks in Mechanics<br>• Modelling and model elements<br>• Vector calculus for forces and torques<br>• Forces and equilibrium in space<br>• Constraints and reactions, characterization of constraint systems<br>• Planar and spatial truss structures<br>• Internal forces and moments for beams and frames<br>• Center of mass, volumn, area and line<br>• Computation of center of mass by intergals, joint bodies<br>• Friction (sliding and sticking)<br>• Friction of ropes |
| **Literature** | **K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009).**<br>**D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1. 11. Auflage, Springer (2011).** |

| Course L1002: Mechanics I (Statics) | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Robert Seifried |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | Forces and equilibrium<br>Constraints and reactions<br>Frames<br>Center of mass<br>Friction<br>Internal forces and moments for beams |
| **Literature** | K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009).<br>D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1. 11. Auflage, Springer (2011). |

| Course L1003: Mechanics I (Statics) | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Robert Seifried |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | Forces and equilibrium<br>Constraints and reactions<br>Frames<br>Center of mass<br>Friction<br>Internal forces and moments for beams |
| **Literature** | K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009).<br>D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1. 11. Auflage, Springer (2011). |

## Module M0577: Non-technical Courses for Bachelors

| | |
|---|---|
| **Module Responsible** | Dagmar Richter |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | None |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | **The Non-technical Academic Programms (NTA)**<br><br>imparts skills that, in view of the TUHH's training profile, professional engineering studies require but are not able to cover fully. Self-reliance, self-management, collaboration and professional and personnel management competences. The department implements these training objectives in its **teaching architecture**, in its **teaching and learning arrangements**, in **teaching areas** and by means of teaching offerings in which students can qualify by opting for **specific competences** and a **competence level** at the Bachelor's or Master's level. The teaching offerings are pooled in two different catalogues for nontechnical complementary courses.<br><br>**The Learning Architecture**<br><br>consists of a cross-disciplinarily study offering. The centrally designed teaching offering ensures that courses in the nontechnical academic programms follow the specific profiling of TUHH degree courses.<br><br>The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also provides orientation knowledge in the form of "profiles"<br><br>The subjects that can be studied in parallel throughout the student's entire study program - if need be, it can be studied in one to two semesters. In view of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in order to encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the course of studies.<br><br>**Teaching and Learning Arrangements**<br><br>provide for students, separated into B.Sc. and M.Sc., to learn with and from each other across semesters. The challenge of dealing with interdisciplinarity and a variety of stages of learning in courses are part of the learning architecture and are deliberately encouraged in specific courses.<br><br>**Fields of Teaching**<br><br>are based on research findings from the academic disciplines cultural studies, social studies, arts, historical studies, migration studies, communication studies and sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor's courses will have the opportunity to learn about business management and start-ups in a goal-oriented way.<br><br>The fields of teaching are augmented by soft skills offers and a foreign language offer. Here, the focus is on encouraging goal-oriented communication skills, e.g. the skills required by outgoing engineers in international and intercultural situations.<br><br>**The Competence Level**<br><br>of the courses offered in this area is different as regards the basic training objective in the Bachelor's and Master's fields. These differences are reflected in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretical level of abstraction in the B.Sc.<br><br>This is also reflected in the different quality of soft skills, which relate to the different team positions and different group leadership functions of Bachelor's and Master's graduates in their future working life.<br><br>**Specialized Competence (Knowledge)**<br><br>Students can<br><br>• locate selected specialized areas with the relevant non-technical mother discipline,<br>• outline basic theories, categories, terminology, models, concepts or artistic techniques in the disciplines represented in the learning area,<br>• different specialist disciplines relate to their own discipline and differentiate it as well as make connections,<br>• sketch the basic outlines of how scientific disciplines, paradigms, models, instruments, methods and forms of representation in the specialized sciences are subject to individual and socio-cultural interpretation and historicity,<br>• Can communicate in a foreign language in a manner appropriate to the subject. |
| *Skills* | **Professional Competence (Skills)**<br><br>In selected sub-areas students can<br><br>• apply basic methods of the said scientific disciplines,<br>• auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specialist discipline,<br>• to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,<br>• justify their decisions on forms of organization and application in practical questions in contexts that go beyond the technical relationship to the subject. |
| **Personal Competence** | |
| *Social Competence* | **Personal Competences (Social Skills)**<br><br>Students will be able<br><br>• to learn to collaborate in different manner, |

| | |
|---|---|
| | • to present and analyze problems in the abovementioned fields in a partner or group situation in a manner appropriate to the addressees,<br>• to express themselves competently, in a culturally appropriate and gender-sensitive manner in the language of the country (as far as this study-focus would be chosen),<br>• to explain nontechnical items to auditorium with technical background knowledge. |
| *Autonomy* | **Personal Competences (Self-reliance)**<br>Students are able in selected areas<br>• to reflect on their own profession and professionalism in the context of real-life fields of application<br>• to organize themselves and their own learning processes<br>• to reflect and decide questions in front of a broad education background<br>• to communicate a nontechnical item in a competent way in writen form or verbaly<br>• to organize themselves as an entrepreneurial subject country (as far as this study-focus would be chosen) |
| **Workload in Hours** | Depends on choice of courses |
| **Credit points** | 6 |

| **Courses** |
|---|
| **Information regarding lectures and courses can be found in the corresponding module handbook published separately.** |

## Module M0650: Introduction to Logistics and Mobility

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Introduction to Scientific Work (L0474) | Lecture | 1 | 2 |
| Freight Traffic and Logistics (L0390) | Lecture | 2 | 2 |
| Freight Traffic and Logistics (L0391) | Project-/problem-based Learning | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Heike Flämig |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students can...<br>• describe the historical development of logistics<br>• name the basic functions of logistics<br>• describe systems and process analysis concepts<br>• describe supply chain management and logistics concepts<br>• describe the connection between logistical decisions and freight traffic development |
| *Skills* | Students can...<br>• apply basic concepts and methods of logistics phase systems<br>• analyze logistical systems and select alternative logistics concepts<br>• solve problems systematically |
| **Personal Competence** | |
| *Social Competence* | Students can...<br>• collaborate in groups to reach and record work outcomes<br>• give appropriate feedback and deal constructively with feedback on their work |
| *Autonomy* | Students can...<br>• assess their own learning progress<br>• conduct literature research and analyses independently and cite them properly<br>• organize and complete the work set independently in terms of both time and content<br>• produce written work independently |
| **Workload in Hours** | Independent Study Time 110, Study Time in Lecture 70 |
| **Credit points** | 6 |

**Course achievement**

| Compulsory | Bonus | Form | Description |
|---|---|---|---|
| No | 2.5 % | Written elaboration | |
| No | 2.5 % | Written elaboration | |
| No | 2.5 % | Presentation | |
| No | 2.5 % | Excercises | |

| | |
|---|---|
| **Examination** | Written exam |
| **Examination duration and scale** | Written exam 60 minutes. 2.5% bonus points each: Excerpt (1 page), homework in group (approx. 20 pages), presentation homework in group (25 minutes), weekly participation in JiTT-questions (10 weeks) |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory |

| Course L0474: Introduction to Scientific Work | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 1 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 46, Study Time in Lecture 14 |
| **Lecturer** | Dr. Michael Florian |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • Introduction to research and science<br>• Finding a topic<br>• Literature review (finding, organizing and analyzing literature, databanks)<br>• Correct citing (adequate behavior with regard to literature, plagiarism, citation types, citation programs)<br>• Structuring a scientific work (organizing material, research questions, exposée, arguments, structure)<br>• Formating and layout (grouping, foot notes, formating in word)<br>• Writing of an excerpt for the term paper and written exam<br>• Discussing possible questions of the exam |
| **Literature** | • Beinke, Christiane; Brinkschulte, Melanie; Bunn, Lothar; Thürmer, Stefan (2011): Die Seminararbeit. Schreiben für den Leser. 2., völlig überarb. Aufl. Konstanz: UVK-Verlagsgesellschaft.<br>• Bitterlich, Axel; Bünting, Karl-Dieter; Pospiech, Ulrike (2007): Schreiben im Studium: mit Erfolg. Ein Leitfaden. 7. Aufl. Berlin: Cornelsen Scriptor.<br>• Boeglin, Martha (2011): Wissenschaftlich arbeiten Schritt für Schritt. Gelassen und effektiv studieren. 2., Aufl. Paderborn, Paderborn: UTB; Fink, Wilhelm.<br>• Brink, Alfred (2013): Anfertigung wissenschaftlicher Arbeiten. Wiesbaden: Springer Fachmedien Wiesbaden.<br>• Hirsch-Weber, Andreas; Scherer, Stefan (2016): Wissenschaftliches Schreiben und Abschlussarbeit in Naturwissenschaften und Ingenieurwissenschaften. Grundlagen - Praxisbeispiele - Übungen. Stuttgart: Verlag Eugen Ulmer.<br>• Kollmann, Tobias; Kuckertz, Andreas; Stöckmann, Christoph (2016): Das 1 x 1 des Wissenschaftlichen Arbeitens. Wiesbaden: Springer Fachmedien Wiesbaden.<br>• Niederhauser, Jürg (2015): Die schriftliche Arbeit kompakt. Von der Ideenfindung bis zur fertigen Arbeit. Für Schule, Hochschule und Universität. 2., aktualisierte und überarb. Aufl. Berlin: Dudenverlag.<br>• Oehlrich, Marcus (2015): Wissenschaftliches Arbeiten und Schreiben. Berlin, Heidelberg: Springer Berlin Heidelberg.<br>• Rost, Friedrich (2012): Lern- und Arbeitstechniken für das Studium. Wiesbaden: VS Verlag für Sozialwissenschaften.<br>• Sesink, Werner (2012): Einführung in das wissenschaftliche Arbeiten. Inklusive E-Learning, Web-Recherche, digitale Präsentation u.a. 9., aktualisierte Aufl. München: Oldenbourg.<br>• Sommer, Roy (2006): Schreibkompetenzen. Erfolgreich wissenschaftlich schreiben. Stuttgart: Klett Lernen und Wissen.<br>• Spoun, Sascha (2011): Erfolgreich studieren. 2., aktualisierte Aufl. München: Pearson Studium.<br>• Theisen, Manuel René (2013): Wissenschaftliches Arbeiten: Erfolgreich bei Bachelor- und Masterarbeit. 16., vollständig überarbeitete Auflage. München: Vahlen.<br>• Voss, Rödiger (2016): Wissenschaftliches Arbeiten ... leicht verständlich. Mit zahlreichen Abbildungen und Übersichten. 4., überarbeitete Auflage. Konstanz, München: UVK Verlagsgesellschaft mbH; UVK/Lucius. |

| Course L0390: Freight Traffic and Logistics | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Heike Flämig |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The course gives an introductory overview of the basics of supply chain management and logistics and their interaction with freight traffic and thus the significance of traffic planning for business activities. In addition, examples of ecologically and economically sustainable best practice are discussed. The following subject areas are covered:<br>• Historical development of logistics<br>• Systemic thinking in logistics<br>• Concepts, trends and strategies in the field of<br>  ◦ Procurement logistics<br>  ◦ Production logistics<br>  ◦ Distribution logistics<br>  ◦ Reverse logistics<br>  ◦ Storage logistics<br>  ◦ Transport logistics<br>  ◦ Handling logistics<br>• Basics of the connection between logistical decisions and traffic<br>• Introduction to traffic policy<br>• Scope for design of (sustainable) freight traffic and logistics<br>The course contents will be consolidated by means of online surveys, Wiki entries by students and special practice sessions and illustrated by means of excursions. |
| **Literature** | ARNOLD, D., ISERMANN, H., KUHN, A., TEMPELMEIER, H. (Hrsg.) (2008): Handbuch Logistik. Berlin, Heidelberg, Springer-Verlag Berlin 3. neu bearb. Auflage.<br>IHDE, G. B. (2001): Transport, Verkehr, Logistik, Gesamtwirtschafliche Aspekte und einzelwirtschaftliche Handhabung. München, Verlag Franz Vahlen, 3. völlig überarbeitete und erweiterte Auflage.<br>PFOHL, H.-C. (2010): Logistiksysteme - Betriebswirtschaftliche Grundlagen. Berlin, Heidelberg, New York, Springer-Verlag, 8. neu bearb. Und aktualisierte Auflage. |

| Course L0391: Freight Traffic and Logistics | |
|---|---|
| **Typ** | Project-/problem-based Learning |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Heike Flämig |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M1004: Logistics Management

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Introduction into Production Logistics (L1222) | Lecture | 2 | 2 |
| Logistics Economics (L1221) | Project-/problem-based Learning | 2 | 4 |

| | |
|---|---|
| **Module Responsible** | Prof. Wolfgang Kersten |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Introduction to Business and Management |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students will be able<br>• to differentiate between production logistics and logistics services,<br>• to describe internal and external areas of production and logistics management,<br>• understand the difference between the different roles in a supply chain,<br>• to describe and explain the actual challenges of production and Logistics management |
| *Skills* | Based on the acquired knowledge students are capable of<br>• Analysing logistics problems and influence factors in companies,<br>• Selecting appropriate methods for solving practical problems,<br>• Applying methods and tools of logistics management for standardized problems. |
| **Personal Competence** | |
| *Social Competence* | Students can<br>• actively participate in discussions and team sessions,<br>• arrive at work results in groups and document them,<br>• develop joint solutions in mixed teams and present them to others. |
| *Autonomy* | Students are able to<br>- perform work steps for solving problems of business logistics independently with the aid of pointers<br>- assess their own state of learning in specific terms and to define further work steps on this basis guided by teachers. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | **Compulsory** / **Bonus** / **Form** / **Description**<br>No / 20 % / Subject theoretical and practical work |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | Data Science: Specialisation Logistics: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Orientierungsstudium: Core Qualification: Elective Compulsory |

| Course L1222: Introduction into Production Logistics | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Dr. Yong Lee |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | In the era of time-competition production and logistics need to be considered as a combined strategic competitive advantage.<br><br>"Introduction in to production logistics" gives an overview over the different disciplinces of production logistics:<br><br>- Development from cost-, quality to time-competitiion,<br>- fundamentals of production and logistics,<br>- phase-oriented and functional subsystems of production logistics,<br>- planning and steering,<br>- analysis and optimization (focus: Lean Management),<br>- production logistics controlling and supply-chain management in production network<br><br>Theory is complented by case studies and guest presentations. |
| **Literature** | • Der Vorlesung zugrunde liegende Literatur (Auswahl):<br><br>- Beer, Stafford (1988): Diagnosing the system for organizations. John Wiley & Sons. Chichester, New York, Brisbane, Toronto 1988.<br>- Ferdows, Kasra; De Meyer, Arnoud (1990): Lasting Improvements in Manufacturing Performance In Search of a New Theory. In: Journal of Operations Management, Vol. 9 (2), 1990, S. 365-384.<br>- Gudehus, Timm (2010): Logistik. Grundlagen - Strategien - Anwendungen. 4. aktual. Aufl. Springer Verlag. Heidelberg/Berlin 2010.<br>- Günther, Hans-Otto/Tempelmeier, Horst (2012): Produktion und Logistik. 9., akt. u. erw. Aufl. Springer Verlag. Berlin/Heidelberg 2012.<br>- Hayes, Robert H.; Schmenner, Roger (1978): How Should You Organize Ma-nufacturing?. In: Harvard Business Review, Vol. 56 (1), 1978, S. 105-118.<br>- Krafcik, John F. (1988): Triumph of the lean production system. In: Sloan Management Review, Vol. 30 (1), S. 41-52.<br>- Maskell, Brian H. (1989a): Performance Measurement for World Class Manufacturing. Part I. Manufacturing Systems, Vol. 7, 1989, S. 62-64.<br>- Pawellek, Günther (2007): Produktionslogistik - Planung - Steuerung - Controlling. Carl Hanser Verlag. München 2007.<br>- Nyhuis, Peter (2008): Beiträge zu einer Theorie der Logistik. Springer Verlag. Berlin/Heidelberg 2008.<br>- Pfohl, Hans-Christian (2010): Logistiksysteme. Betriebswirtschaftliche Grundlagen. 8., neu bearb. u. aktual. Aufl. Springer Verlag. Berlin/Heidelberg 2010.<br>- Schuh, Günther (1988): Gestaltung und Bewertung von Produktvarianten. Ein Beitrag zur systematischen Planung von Serienprodukten. Dissertation. RWTH Aachen 1988.<br>- Takeda, Hitoshi (2012): Das synchrone Produktionssystem. Just-in-time für das ganze Unternehmen. 7. Aufl. Verlag Franz Vahlen. München 2012.<br>- Ten Hompel, Michael/Sadowsky, Volker/Beck, Maria (2011): Kommissionierung. Materialflusssysteme 2 - Planung und Berechnung der Kommissionierung in der Logistik. Springer Verlag. Berlin/Heidelberg 2011.<br>- Wannenwetsch, Helmut (2007): Integrierte Materialwirtschaft und Logistik. Beschaffung, Logistik, Materialwirtschaft und Produktion.3., akt. Aufl. Springer Verlag. Berlin/Heidelberg 2007.<br>- Wiendahl, Hans-Peter/Reichardt, Jürgen/Nyhuis, Peter (2014): Handbuch Fabrikplanung. Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktionsstätten. 2., überarb. u. erw. Aufl. Carl Hanser Verlag. München/Wien 2014.<br>- Wildemann, Horst (1997): Fertigungsstrategien - Reorganisation für eine schlanke Produktion und Zulieferung. 3. Aufl. TCW Transfer-Centrum-Verlag. München 1997.<br>- Wildemann, Horst (2008): Produktionssysteme. Leitfaden zur methoden-gestützten Reorganisation der Produktion. 6. Aufl. 2008, TCW München.<br>- Wildemann, Horst (2009): Logistik Prozeßmanagement. 4. Aufl. TCW Transfer-Centrum-Verlag. München 2009.<br>- Zäpfel, Günther (2001): Grundzüge des Produktions- und Logistikmanagement. 2., unwesentlich veränd. Aufl. R. Oldenbourg Verlag. München/Wien 2001. |

| Course L1221: Logistics Economics | |
|---|---|
| **Typ** | Project-/problem-based Learning |
| **Hrs/wk** | 2 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 92, Study Time in Lecture 28 |
| **Lecturer** | Dr. Meike Schröder |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | • Explanation of basic concepts of logistics and outline of the scope of the logistics business, identification of global logistics networks and relationships<br>• Stakeholder: Introduction to the different kinds of logistics service providers, characterization of services of consulting firms for logistics companies<br>• Strategy: Influence of the business strategies on business logistics<br>• Outsourcing: Decision processes, possibilities and risks of outsourcing of logistics services<br>• Market: Logistics in Germany, relevance of logistics for the city of Hamburg<br>• Research: Outlook on current issues in academic research, as well as an outline of supplementary management methods for logistics |
| **Literature** | • Arnold, D.; Isermann, H.; Kuhn, A.; Tempelmeier, H. (2008): Handbuch Logistik, Berlin: Springer, 2008, ISBN: 3-540-72928-3<br>• Ballou, R. H. (2004): Business logistics, supply chain management: planning, organizing, and controlling the supply chain, 5. ed., internat. ed., Upper Saddle River, NJ: Pearson Prentice Hall, 2004, ISBN: 0-13-123010-7<br>• Bretzke, W.-R. (2008): Logistische Netzwerke, Springer, Berlin, 2008<br>• Gleißner, H.; Femerling, C. (2008): Logistik - Grundlagen, Übungen, Fallbeispiele, Wiesbaden: Gabler, 2008, ISBN: 978-3-8349-0296-2<br>• Kersten, W.; Hohrath, P.; Koch, J. (2007): Innovative logistics services : Advantage and Disadvantages of Outsourcing Complex Service Bundles, in: Key Factors for Successful Logistics, Berlin: Erich Schmidt Verlag GmbH & Co. KG, 2007<br>• Kersten, W.; Koch, J. (2007): Motive für das Outsourcing komplexer Logistikdienstleistungen, in: Handbuch Kontraktlogistik : Management komplexer Logistikdienstleistungen, Weinheim<br>• Schulte, C. (2009): Logistik: Wege zur Optimierung der Supply Chain, 5. überarb. und erw. Aufl., München: Vahlen, 2009, ISBN: 3-8006-3516-X<br>• Wildemann, H. (1997): Logistik Prozessmanagement - Organisation und Methoden, München: TCW Transfer-Centrum Verlag, 1997, ISBN: 3-931511-17-0 |

## Module M0851: Mathematics II

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Analysis II (L1025) | Lecture | 2 | 2 |
| Analysis II (L1026) | Recitation Section (large) | 1 | 1 |
| Analysis II (L1027) | Recitation Section (small) | 1 | 1 |
| Linear Algebra II (L0915) | Lecture | 2 | 2 |
| Linear Algebra II (L0916) | Recitation Section (small) | 1 | 1 |
| Linear Algebra II (L0917) | Recitation Section (large) | 1 | 1 |

| | |
|---|---|
| **Module Responsible** | Prof. Anusch Taraz |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Mathematics I |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • Students can name further concepts in analysis and linear algebra. They are able to explain them using appropriate examples.<br>• Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples.<br>• They know proof strategies and can reproduce them. |
| *Skills* | • Students can model problems in analysis and linear algebra with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods.<br>• Students are able to discover and verify further logical connections between the concepts studied in the course.<br>• For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. |
| **Personal Competence** | |
| *Social Competence* | • Students are able to work together in teams. They are capable to use mathematics as a common language.<br>• In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers. |
| *Autonomy* | • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them.<br>• Students have developed sufficient persistence to be able to work for longer periods in a goal-oriented manner on hard problems. |
| **Workload in Hours** | Independent Study Time 128, Study Time in Lecture 112 |
| **Credit points** | 8 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 60 min (Analysis II) + 60 min (Linear Algebra II) |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Core Qualification: Compulsory<br>Civil- and Environmental Engineering: Core Qualification: Compulsory<br>Bioprocess Engineering: Core Qualification: Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Electrical Engineering: Core Qualification: Compulsory<br>Energy and Environmental Engineering: Core Qualification: Compulsory<br>Computational Science and Engineering: Core Qualification: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Orientierungsstudium: Core Qualification: Elective Compulsory<br>Naval Architecture: Core Qualification: Compulsory<br>Process Engineering: Core Qualification: Compulsory |

| Course L1025: Analysis II | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | • power series and elementary functions<br>• interpolation<br>• integration (proper integrals, fundamental theorem, integration rules, improper integrals, parameter dependent integrals<br>• applications of integration (volume and surface of bodies of revolution, lines and arc length, line integrals<br>• numerical quadrature<br>• periodic functions |
| **Literature** | • http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html |

| Course L1026: Analysis II | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L1027: Analysis II | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L0915: Linear Algebra II | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Anusch Taraz, Prof. Marko Lindner |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | • general vector spaces: subspaces, Euclidean vector spaces<br>• linear mappings: basis transformation, orthogonal projection, orthogonal matrices, householder matrices<br>• linear regression: normal equations, linear discrete approximation<br>• eigenvalues: diagonalising matrices, normal matrices, symmetric and Hermite matrices<br>• system of linear differential equations<br>• matrix factorizations: LR-decomposition, QR-decomposition, Schur decomposition, Jordan normal form, singular value decomposition |
| **Literature** | • T. Arens u.a. : Mathematik, Spektrum Akademischer Verlag, Heidelberg 2009<br>• W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994<br>• W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994<br>• G. Strang: Lineare Algebra, Springer-Verlag, 2003<br>• G. und S. Teschl: Mathematik für Informatiker, Band 1, Springer-Verlag, 2013 |

| Course L0916: Linear Algebra II | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Anusch Taraz, Prof. Marko Lindner |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | • linear mappings: basis transformation, orthogonal projection, orthogonal matrices, householder matrices<br>• linear regression: QR-decomposition, normal equations, linear discrete approximation<br>• eigenvalues: diagonalising matrices, normal matrices, symmetric and Hermite matrices, Jordan normal form, singular value decomposition<br>• system of linear differential equations |
| **Literature** | • W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994<br>• W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 |

| Course L0917: Linear Algebra II | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Anusch Taraz, Prof. Marko Lindner, Dr. Christian Seifert |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M1261: Management

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Finance and Accounting (L1707) | Lecture | 2 | 3 |
| Foundations of Management (L1706) | Lecture | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Thomas Wrona |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basics of business studies |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students will accumulate extensive knowledge about different aspects of management after having participated in this module.<br>• Students are able to give an overview of the activities of management and describe processes and content of management.<br>• Students are able to identify the features and procedures by which a modern organization can be managed.<br>• Students are able to explain and analyze relationships between management activities.<br>• Students are able to describe and apply methods of finance and accounting.<br>Students are able to develop procedures and basic approaches in the context of investment and financing decisions for the company. |
| *Skills* | • The students are able to recognize and evaluate important skills for management.<br>• The students are able to develop their own understanding of successful leadership in organizations and evaluate strategies accordingly.<br>• The Students are able to differentiate between different environmental contingencies and asses the underlying risk potentials.<br>Students are able to utilize models and methods of accounting and apply it from a business perspective. |
| **Personal Competence** | |
| *Social Competence* | After attending the module students will be able to<br>• lead and take part in strategy-related discussions<br>• present results, both in written and verbal form<br>work respectful with others in a team. |
| *Autonomy* | The students are able to gather, analyze, and critically reflect on information and data and convert it into manageable summaries. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 90 min |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory |

### Course L1707: Finance and Accounting

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Ulrich Pape |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Introduction to the theory and practice of finance and accounting:<br>The focus will be on basic principles of capital budgeting, finance and accounting and the underlying various methods of accounting. |
| **Literature** | Wird zu Veranstaltungsbeginn bekannt gegeben. |

### Course L1706: Foundations of Management

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Thomas Wrona |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Introduction to the theory and practice of management:<br>The fundamentals of corporate governance will be taught, as well as an in-depth perspective on activities, characteristics and methods of management. |
| **Literature** | Wird zum Veranstaltungsbeginn bekannt gegeben. |

## Module M0696: Mechanics II: Mechanics of Materials

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Mechanics II (L0493) | Lecture | 2 | 2 |
| Mechanics II (L0494) | Recitation Section (small) | 2 | 2 |
| Mechanics II (L1691) | Recitation Section (large) | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Christian Cyron |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Mechanics I |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students name the fundamental concepts and laws of statics such as stresses, strains, Hooke's linear law. |
| *Skills* | The students apply the mathematical/mechanical analysis and modeling.<br><br>The students apply the fundamental methods of elasto statics to simply engineering problems.<br><br>The students estimate the validity and limitations of the introduced methods. |
| **Personal Competence** | |
| *Social Competence* | - |
| *Autonomy* | - |
| **Workload in Hours** | Independent Study Time 96, Study Time in Lecture 84 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 90 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Core Qualification: Compulsory<br>Civil- and Environmental Engineering: Core Qualification: Compulsory<br>Data Science: Specialisation Mechanics: Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Orientierungsstudium: Core Qualification: Elective Compulsory<br>Naval Architecture: Core Qualification: Compulsory |

### Course L0493: Mechanics II

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Christian Cyron |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | stresses and strains<br>Hooke's law<br>tension and compression<br>torsion<br>bending<br>stability<br>buckling<br>energy methods |
| **Literature** | • Gross, D., Hauger, W., Schröder, J., Wall, W.A.: Technische Mechanik 1, Springer<br>• Gross, D., Hauger, W., Schröder, J., Wall, W.A.: Technische Mechanik 2 Elastostatik, Springer |

| Course L0494: Mechanics II | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Christian Cyron |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L1691: Mechanics II | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Christian Cyron, Dr. Konrad Schneider |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M1286: Technical Logistics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Technical Logistics (L1746) | Lecture | 3 | 3 |
| Technical Logistics (L1747) | Recitation Section (small) | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Jochen Kreutzfeldt |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Successful completion of the modules „Introduction into logistics and mobility“, "Technical mechanics 1", "Mathematics 1" |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students will acquire the following skills:<br>1. The students know technical solutions for solving logistical problems in the areas of warehousing, conveying, sorting, order picking and identifying.<br>2. The students know approaches to introducing a selected technical solution.<br>3. The students know practical examples of the presented technical solutions. |
| *Skills* | The students will acquire the following skills:<br>1. The students can select different technical solutions for logistic problems of warehousing, conveying, sorting, order picking and identifying.<br>2. The students are able to evaluate critically the presented technical solutions with respect to their applicability for different logistical problems and compare different alternatives.<br>3. The students are able to assess the impact of selected solutions. |
| **Personal Competence** | |
| *Social Competence* | The students will acquire the following social skills:<br>1. The students will be able to sketch technical solutions for solving logistical problems of warehousing, conveying, sorting, order picking and identifying and reflect on their own contribution.<br>2. The technical solutions from the group are jointly documented and presented.<br>3. The students are able to present their technical solutions to an audience and they can derive new ideas and improvements from the feedback. |
| *Autonomy* | The students will acquire the following competencies:<br>1. The students are able to sketch autonomously, but under supervision, technical solutions to logistical problems of warehousing, conveying, sorting, order picking and identifying.<br>2. The students are able to evaluate their technical solutions and discuss the pros and cons. |
| **Workload in Hours** | Independent Study Time 110, Study Time in Lecture 70 |
| **Credit points** | 6 |
| **Course achievement** | Compulsory: No; Bonus: 10 %; Form: Excercises; Description: Bonuspunktaufgaben in Maple |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory |

| Course L1746: Technical Logistics | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 3 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 48, Study Time in Lecture 42 |
| **Lecturer** | Prof. Jochen Kreutzfeldt |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | The lecture gives an introduction in solutions and approaches of technical logistics. Five main topics will be addressed:<br>(1) warehousing<br>(2) conveying<br>(3) sorting<br>(4) order picking<br>(5) identifying<br>For each topic, various technical solutions are presented and discussed under consideration of advantages and disadvantages. This content is supplemented by practical examples that can be complemented by inviting guest lecturers.<br>In the exercises selected technical solutions will be presented and discussed for certain problems and practiced by the students. |
| **Literature** | Griemert, Rudolf (2015): Fördertechnik. Auswahl und Berechnung von Elementen und Baugruppen. [S.l.]: Morgan Kaufmann.<br>Hompel, Michael ten; Schmidt, Thorsten; Nagel, Lars (2007): Materialflusssysteme. Förder- und Lagertechnik. 3. Aufl. Berlin: Springer.<br>Hompel, Michael ten; Büchter, Hubert; Franzke, Ulrich (2008): Identifikationssysteme und Automatisierung. [Intralogistik]. Berlin, Heidelberg: Springer.<br>Hompel, Michael ten; Schmidt, Thorsten (2010): Warehouse Management. Organisation und Steuerung von Lager- und Kommissioniersystemen. 4. Aufl. Berlin: Springer.<br>Hompel, Michael ten; Beck, Maria; Sadowsky, Volker (2011): Kommissionierung. Materialflusssysteme 2 - Planung und Berechnung der Kommissionierung in der Logistik. Berlin [u.a.]: Springer.<br>Jodin, Dirk; Hompel, Michael ten (2012): Sortier- und Verteilsysteme. Grundlagen, Aufbau, Berechnung und Realisierung. 2. Aufl. Berlin: Springer.<br>Martin, Heinrich (2014): Transport- und Lagerlogistik. Planung, Struktur, Steuerung und Kosten von Systemen der Intralogistik. 9., vollst. überarb. u. akt. Aufl. 2014. Wiesbaden: Imprint: Springer Vieweg. |

| Course L1747: Technical Logistics | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Jochen Kreutzfeldt |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0887: Transportation Planning and Traffic Engineering

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Transport Planning and Traffic Engineering (L0997) | Project-/problem-based Learning | 4 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Carsten Gertz |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | None |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to<br>• understand the facts, contexts and objectives of transport planning.<br>• correctly apply definitions and concepts of transport planning.<br>• reproduce basic concepts of transport modelling.<br>• explain the fundamentals of traffic engineering and transport infrastructure construction. |
| *Skills* | Students are able to<br>• analyse transport supply based on key metrics.<br>• estimate transport demand using key metrics.<br>• design transport networks, links and junctions.<br>• calculate traffic signal plans.<br>• assess transport concepts. |
| **Personal Competence** | |
| *Social Competence* | Students are able to<br>• get together in groups and constructively discuss and analyse set problems.<br>• in a group agree on solutions and document them. |
| *Autonomy* | Students are able to<br>• produce reports on group work.<br>• structure the tasks and timing for working out a set problem. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | Compulsory: Yes; Bonus: None; Form: Group discussion<br>Compulsory: No; Bonus: 5 %; Form: Excercises<br>Description |
| **Examination** | Subject theoretical and practical work |
| **Examination duration and scale** | Project report in four work packages, in small groups, during the semester; mandatory interim presentation |
| **Assignment for the Following Curricula** | Civil- and Environmental Engineering: Core Qualification: Compulsory<br>Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory<br>Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory<br>Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Core Qualification: Compulsory |

| Course L0997: Transport Planning and Traffic Engineering | |
|---|---|
| **Typ** | Project-/problem-based Learning |
| **Hrs/wk** | 4 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Lecturer** | Prof. Carsten Gertz |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The course provides an introductory overview over the fundamentals of urban and regional transport planning, including the sub-topic traffic engineering. The following subject areas are covered:<br>• objectives of transport planning,<br>• key mobility metrics,<br>• measuring and predicting demand,<br>• designing and planning transport infrastructure,<br>• fundamentals of traffic engineering and<br>• an introduction to transport concepts and planning processes. |
| **Literature** | Steierwald, Gerd; Kühne, Hans Dieter; Vogt, Walter (Hrsg.) (2005)<br>Stadtverkehrsplanung: Grundlagen, Methoden, Ziele. Springer Verlag. Berlin.<br>Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden.<br>Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin.<br>Forschungsgesellschaft für Straßen- und Verkehrswesen (2007) Richtlinien für die Anlage von Stadtstraßen – RASt 06. FGSV-Verlag. Köln (FGSV, 200). |

## Module M1319: Selected Problems of Management

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Foundations of Organization (L1230) | Lecture | 2 | 3 |
| Change Management (L1708) | Lecture | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Thomas Wrona |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Module Unternehmensführung (Management)<br><br>Course Unternehmensstrategien (corporate Strategies) |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able<br><br>• to describe and explain typical structures of organizations<br>• to explain the basic principles of supply chain management<br>• to describe forms of change and activities, characteristics and methods of a planned change process<br>• to describe organizational change processes as social processes. |
| *Skills* | Students are able to<br><br>• develop proposals for the design of organizational structures in companies on the basis of situational factors<br>• design, analyze and optimize organizational processes based on examples<br>• evaluate processes of change in real-world case studies and to make proposals for its design. |
| **Personal Competence** | |
| *Social Competence* | Students are able<br><br>• organize themselves in groups for case study teaching<br>• work out the assignments with their fellow students<br>• develop their own action position within the framework of individual case studies, to defend the underlying arguments and if necessary to modify in the discourse.<br>• to present the results of practical tasks in plenary. |
| *Autonomy* | The students are able<br><br>• to identify and close gaps in knowledge in the issues mentioned above<br><br>• to investigate suitable learning materials independently.<br>• to make an individual contribution to the solution of tasks. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Elective Compulsory |

| Course L1230: Foundations of Organization | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Christian Ringle |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • The Study of Organizations<br>• Organizational Structure and Design<br>• The Processes of Organizations (Design, Analysis, Optimization)<br>• Basics of Supply Chain Management |
| **Literature** | Recommended Literature:<br>- Jones, G. R. (2010): Organizational Theory, Design, and Change, 6/e.<br>- Gibson, J.L./Ivancevich, J.M./Donnelly, J.H./Konopaske, R. (2009): Organizations - Behavior, Structure, Processes, 13/e.<br>- Slack, N./Chambers, S./Johnston, R.(2004): Operations Management, 4/e.<br><br>Further reading:<br>- Becker, J./Kugeler, M./Rosemann, M. (2005): Prozessmanagement: Ein Leitfaden zur prozessorientierten Organisationsgestaltung, 5. Auflage.<br>- Jones, G.R./Bouncken, R. (2008): Organisation: Theorie, Design und Wandel, 5. Auflage.<br>- Hansmann, K.-W. (2006): Industrielles Management, 8. Auflage.<br>- Thonemann, U. (2010): Operations Management: Konzepte, Methoden und Anwendungen, 2. Auflage.<br>- Voigt, K.-I. (2008): Industrielles Management - Industriebetriebslehre aus prozessorientierter Sicht. |

| Course L1708: Change Management | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Thomas Wrona |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Introduction to the theory and practice of change management:<br><br>The focus will be on the different continuous forms of change, on the activities, characteristics and methods of planned change as well as on change management as a form of a social process. The acquired knowledge is practically applied on the basis of selected case studies in the lectures to make students familiar with the use and application of different analysis techniques. A guest speaker complements the content of the lecture by providing insights into the practice of change management. |
| **Literature** | Bamberger, I./Wrona, T. (2012): Strategische Unternehmensführung. Strategien - Systeme - Prozesse, München.<br><br>Bamberger, I./Wrona, T. (Hrsg.) (2012): Strategische Unternehmensberatung. Konzeptionen, Prozesse, Methoden, 6. erw. Aufl., Wiesbaden 2012.<br><br>Doppler, K./Lauterburg, C. (2008): Change-Management: den Unternehmenswandel gestalten, 12. aktualisierte und erw. Aufl., Frankfurt/Main u.a.: Campus-Verlag 2008. |

## Module M1295: Business Issues in Logistics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Business Issues in Logistics (L1762) | Seminar | 2 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Heike Flämig |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | todo |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | todo |
| *Skills* | todo |
| **Personal Competence** | |
| *Social Competence* | todo |
| *Autonomy* | todo |
| **Workload in Hours** | Independent Study Time 152, Study Time in Lecture 28 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written elaboration |
| **Examination duration and scale** | todo |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Elective Compulsory |

### Course L1762: Business Issues in Logistics

| | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 2 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 152, Study Time in Lecture 28 |
| **Lecturer** | Prof. Dr. habil. Rajnish Tiwari |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | todo |
| **Literature** | Wird zu Beginn des jeweiligen Studiensemesters mit Bezug auf das ausgewählte Themenfeld bekannt gegebenen. |

## Module M0608: Basics of Electrical Engineering

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Basics of Electrical Engineering (L0290) | Lecture | 3 | 4 |
| Basics of Electrical Engineering (L0292) | Recitation Section (small) | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Thorsten Kern |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basics of mathematics |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students can to draw and explain circuit diagrams for electric and electronic circuits with a small number of components. They can describe the basic function of electric and electronic componentes and can present the corresponding equations. They can demonstrate the use of the standard methods for calculations. |
| *Skills* | Students are able to analyse electric and electronic circuits with few components and to calculate selected quantities in the circuits. They apply the ususal methods of the electrical engineering for this. |
| **Personal Competence** | |
| *Social Competence* | none |
| *Autonomy* | Students are able independently to analyse electric and electronic circuits and to calculate selected quantities in the circuits. |
| **Workload in Hours** | Independent Study Time 110, Study Time in Lecture 70 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 135 minutes |
| **Assignment for the Following Curricula** | Bioprocess Engineering: Core Qualification: Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Energy and Environmental Engineering: Core Qualification: Compulsory<br>Green Technologies: Energy, Water, Climate: Core Qualification: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Orientation Studies: Core Qualification: Elective Compulsory<br>Naval Architecture: Core Qualification: Compulsory<br>Process Engineering: Core Qualification: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory |

### Course L0290: Basics of Electrical Engineering

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 3 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 78, Study Time in Lecture 42 |
| **Lecturer** | Prof. Thorsten Kern |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | DC networks: Current, voltage, power, Kirchhoff's laws, equivalent sources, network analysis<br><br>AC: Characteristics, RMS, complexe representation, phasor diagrams, power<br>Three phase AC: Characterisitics, star-delta- connection, power, transformer<br><br>Elektronics: Principle, operating behaviour and application of electronic devises as diode, Zener-diode, thyristor, transistor operational amplifier |
| **Literature** | Alexander von Weiss, Manfred Krause: "Allgemeine Elektrotechnik"; Viweg-Verlag, Signatur der Bibliothek der TUHH: ETB 309<br>Ralf Kories, Heinz Schmitt - Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122<br>"Grundlagen der Elektrotechnik" - andere Autoren |

| Course L0292: Basics of Electrical Engineering | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Thorsten Kern, Weitere Mitarbeiter |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | Excercises to the analysis of circuits and the calculation of electrical quantities th the topics:<br><br>DC networks: Current, voltage, power, Kirchhoff's laws, equivalent sources,<br>network analysis<br><br>AC: Characteristics, RMS, complexe representation, phasor diagrams, power<br>Three phase AC: Characterisitics, star-delta- connection, power, transformer<br><br>Elektronics: Principle, operating behaviour and application of electronic devises as diode, Zener-diode, thyristor, transistor operational amplifier |
| **Literature** | Alexander von Weiss, Manfred Krause: "Allgemeine Elektrotechnik"; Viweg-Verlag, Signatur der Bibliothek der TUHH: ETB 309<br>Ralf Kories, Heinz Schmitt - Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122<br>"Grundlagen der Elektrotechnik" - andere Autoren |

## Module M1082: Mathematics III - Differential Equations I

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Differential Equations 1 (Ordinary Differential Equations) (L1031) | Lecture | 2 | 2 |
| Differential Equations 1 (Ordinary Differential Equations) (L1032) | Recitation Section (small) | 1 | 1 |
| Differential Equations 1 (Ordinary Differential Equations) (L1033) | Recitation Section (large) | 1 | 1 |

| | |
|---|---|
| **Module Responsible** | Dozenten des Fachbereiches Mathematik der UHH |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Mathematics I and II |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • Students can name the basic concepts in Mathematics III. They are able to explain them using appropriate examples.<br>• Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples<br>• They know proof strategies and can reproduce them. |
| *Skills* | • Students can model problems in Mathematics III with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods<br>• Students are able to discover and verify further logical connections between the concepts studied in the course.<br>• For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. |
| **Personal Competence** | |
| *Social Competence* | • Students are able to work together in teams. They are capable to use mathematics as a common language.<br>• In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers. |
| *Autonomy* | • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them.<br>• Students have developed sufficient persistence to be able to work for longer periods in a goad-oriented manner on hard problems. |
| **Workload in Hours** | Independent Study Time 64, Study Time in Lecture 56 |
| **Credit points** | 4 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory |

### Course L1031: Differential Equations 1 (Ordinary Differential Equations)

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | Main features of the theory and numerical treatment of ordinary differential equations<br>• Introduction and elementary methods<br>• Exsitence and uniqueness of initial value problems<br>• Linear differential equations<br>• Stability and qualitative behaviour of the solution<br>• Boundary value problems and basic concepts of calculus of variations<br>• Eigenvalue problems<br>• Numerical methods for the integration of initial and boundary value problems<br>• Classification of partial differential equations |
| **Literature** | • http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html |

| Course L1032: Differential Equations 1 (Ordinary Differential Equations) | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L1033: Differential Equations 1 (Ordinary Differential Equations) | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Dozenten des Fachbereiches Mathematik der UHH |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M1013: Traffic systems and handling technology

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Transport- and Handling-Technology (L0715) | Lecture | 2 | 3 |
| Transport- and Handling-Technology (L0718) | Recitation Section (small) | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Carlos Jahn |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to:<br>- explain and classify the terms and their meaning in transport and handling technology<br>- reflect current political conditions and technical developments in transport and handling technology;<br>- identify actors and their tasks in the maritime transport chain (pre-carriage, carriage, on-carriage);<br>- determine, compare and assign suitable applications and areas of use of transport and handling techniques based on the questions: What will be transported? On what should it be transported? Where is the cargo to be handled? By which means? |
| *Skills* | Students can, on the basis of the knowledge they have acquired:<br>- identify and evaluate key performance indicators (e.g. transport times, storage costs, etc.) in the maritime transport chain;<br>- select and dimension suitable techniques for defined transport and handling tasks and critically evaluate approaches to solutions;<br>- differentiate and evaluate transport and handling technologies (e.g. by calculating carbon footprints, transport times and costs for different modes of transport as well as point-to-point or hub-and-spoke freight transport in aviation). |
| **Personal Competence** | |
| *Social Competence* | Students are able to:<br>- successfully and respectfully discuss and organise research tasks in small groups in the context of a comprehensive written elaboration during the semester and to present and represent them in a comprehensible way;<br>- describe, differentiate and evaluate problems (e.g. in the joint compilation of factual knowledge on topics such as slow steaming in container shipping or the establishment of different maritime supply chains);<br>- participate in technical discussions on topics from the transport and handling technology. |
| *Autonomy* | After completion of the module students capable to:<br>- acquire knowledge of parts of the subject area independently and apply the acquired knowledge to solve new problems;<br>- conduct a systematic literature search and record this in a scientific text;<br>- critically reflect on the results of their own work. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | Compulsory: No; Bonus: 10 %; Form: Written elaboration; Description: |
| **Examination** | Written exam |
| **Examination duration and scale** | 90 minutes |
| **Assignment for the Following Curricula** | Data Science: Specialisation Logistics: Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory |

| Course L0715: Transport- and Handling-Technology | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Carlos Jahn |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The course Transportation and Handling Technology teaches the basics, possible applications and areas of application of transportation and handling techniques. The students are enabled to select, evaluate and dimension suitable techniques for defined transport and handling tasks. In addition, a basic knowledge of the relevant guidelines and standards is taught. The lecture is part of the bachelor's program "Logistics and Mobility" and is particularly aimed at students in their third semester. The aim is to convey the basics, possible applications and usefulness of the various transport and handling techniques. The students should be enabled to select, evaluate and dimension suitable techniques for defined transport and handling tasks. In addition to the transported goods and loading units, the various means of transport, handling terminals and the necessary equipment play a special role. Furthermore, it is possible to build up a basic knowledge of the relevant guidelines and standards. In addition to road, rail, water (inland and sea shipping), air, combined transport is also addressed.<br><br>Contents of the lecture<br>• Basics, possible applications, usefulnes of different transport and handling techniques<br>• Overview of transported goods, loading units, means of transport, handling terminals and equipment<br>• Representation of the modes of transport: road, rail, water (inland waterway, ocean-going vessel), air, combined transport |
| **Literature** | Clausen, Uwe; Geiger, Christiane (2013). Verkehrs- und Transportlogistik.<br><br>Conrady, Roland; Fichert, Frank; Sterzenbach, Rüdiger (2019). Luftverkehr: Betriebswirtschaftliches Lehr- und Handbuch.<br><br>Gleißner, Harald; Femerling, Christian (2012). Logistik: Grundlagen - Übungen - Fallbeispiele.<br><br>Kranke, Andre; Schmied, Martin; Schön, Andrea D. (2011). CO2-Berechnung in der Logistik: Datenquellen, Formeln, Standards.<br><br>Pachl, Jörn (2018). Systemtechnik des Schienenverkehrs: Bahnbetrieb planen, steuern und sichern.<br><br>Rodrigue, Jean-Paul (2020). Geography of Transport Systems. |

| Course L0718: Transport- and Handling-Technology | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Carlos Jahn |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The exercise consists of two parts. In the first part, the topics presented in the lecture are deepened by means of guided quantitative group exercises.<br><br>In the second part of the exercise, students work on a topic throughout the semester in the context of research-based learning.<br><br>This takes place in so-called research-based learning: "Research-based learning is characterized [...] by the fact that the students (co-)design, experience and reflect on the process of a research project, which is aimed at gaining knowledge that is also of interest to third parties, in its essential phases - from the development of questions and hypotheses to the selection and execution of methods to the examination and presentation of the results in independent work or in active participation in a comprehensive project" (translated from German / Huber 2009, p.11).<br><br>The students apply the knowledge they have acquired in the course of two written papers. These written assignments are carried out as group work.<br><br>The contents of the written papers deal, for example, with the presentation of the entire maritime supply chain of different types of goods, such as containers, crude oil, project cargo or RoRo.<br><br>Students can achieve a total of up to 10% for both written papers. |
| **Literature** | Biebig , Peter; Althof, Wolfgang.; Wagener, Norbert (2008) Seeverkehrswirtschaft : Kompendium. 4. Auflage.<br><br>Geisler, Alexander; Johns, Dirk Max (2018): See Schiff Ladung: Fachbuch für Schifffahrtskaufleute: von Praktikern für Praktiker, 2. Auflage.<br><br>Bänsch, Axel; Alewell, Dorothea; Moll, Tobias (2020): Wissenschaftliches Arbeiten, 12. Auflage.<br><br>Voss, Rüdiger (2019): Wissenschaftliches Arbeiten: ... leicht verständlich. 6. Auflage. |

## Module M0987: Legal Foundations of Transportation and Logistics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Legal Foundations of Transportation and Logistics (L1186) | Lecture | 2 | 2 |
| Legal Foundations of Transportation and Logistics (L1187) | Recitation Section (large) | 1 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Heike Flämig |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to...<br>• describe the systematics of transport law and logistics law<br>• explain the legal connections in transport and logistics |
| *Skills* | Students can...<br>• analyze and solve questions of law for transport and logistics<br>• discuss and systematically evaluate law cases and verify them with applicable laws |
| **Personal Competence** | |
| *Social Competence* | Students can come to results in groups and document them. |
| *Autonomy* | Students can...<br>• develop systematical thinking<br>• search and analyze laws independently<br>• answer questions of law concerning transport and logistics independently |
| **Workload in Hours** | Independent Study Time 78, Study Time in Lecture 42 |
| **Credit points** | 4 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 60 minutes |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory |

### Course L1186: Legal Foundations of Transportation and Logistics

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Dr. Niels Witt |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • Basics of german law<br>• regulations of the HGB<br>• international conventions<br>• maritime trade law<br>• contract logistics<br>• complex logistics chains |
| **Literature** | Aktueller Text des Bürgerlichen Gesetzbuches und Handelsgesetzbuches |

### Course L1187: Legal Foundations of Transportation and Logistics

| | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 46, Study Time in Lecture 14 |
| **Lecturer** | Dr. Niels Witt |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M1704: Gamification of Strategic Thinking

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Gamification of Strategic Thinking (L2708) | Seminar | 4 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Matthias Meyer |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | None |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • recognize and analyze relationships and interdependencies between different strategic decision areas<br>• understand problem-related terms, theories and methods of business administration and relate these to practical situations |
| *Skills* | • make well-founded decisions in realistic settings by drawing on the business administration knowledge<br>• consider in parallel and balance several relevant factors when making business-related decisions (e.g. financial situation, behavior of competitors, production capacities)<br>• critically analyze decisions in hindsight and deduce consequences for future decisions from this analysis<br>• analyze and explain economic and strategic phenomena by drawing on business administration theories and methods |
| **Personal Competence** | |
| *Social Competence* | • form stable work groups with fellow students, even those, who were previously unknown, and agree on work habits<br>• arrive at a consensus as a team when making management decisions and, if necessary, to solve conflicts along the way to achieving the consensus<br>• adequately present the situation of a (fictitious) organization and their decision making to teachers and fellow students |
| *Autonomy* | • make and justify decisions in simulated professional situations<br>• reflect their own actions in hindsight and arrive at suggestions for improvements in a structured way<br>• critically depict and reflect situations in a structured way, both, orally as well as in written reports<br>• make transfers from theory into practice |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Subject theoretical and practical work |
| **Examination duration and scale** | Different achievements (single/team) - learning diary, presentations, reflections, essay |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Elective Compulsory<br>Logistics and Mobility: Core Qualification: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Core Qualification: Elective Compulsory |

### Course L2708: Gamification of Strategic Thinking

| | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 4 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Lecturer** | Prof. Matthias Meyer, Thorsten Kodalle |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The seminar "Gamification of Strategic Thinking" is offered as part of the elective course of studies "Logistics and Mobility" and currently offers space for 25 students. In cooperation with the German Armed Forces Command and Staff College, the seminar aims to teach strategic methods within the framework of a wargaming approach. For this purpose, the course consists of two blocks, which take place parallel to each other throughout the semester. In the theoretical block, students are taught the basics of various methods for strategy development and management (including SWOT analysis, SCRUM or Kanban). In the second block, the students apply the methods they have learned on the basis of the board game "Sycthe". For this, the students are divided into five groups with five members each. Each of these groups plays a "party" of the board game and is supposed to develop a strategy with the help of the learned methods that helps the respective team to win. Afterwards, the experiences will be reflected upon by means of a written elaboration and a proposal for an own business wargame will be developed. |
| **Literature** | Green, K. C. (2005), "Game theory, simulated interaction, and unaided judgment for forecasting decisions in conflicts," International Journal of Forecasting, 21, 463-472.<br><br>Romeike. F., Spitzner, J. (2013): Von Szenarioanalyse bis Wargaming, Betriebswirtschaftliche Simulationen im Praxiseinsatz, Wiley-VCH<br><br>Sabin, P. (2012), Simulating War - Studying Conflict through Simulation Games, Part 1, Bloomsbury Press, London. |

## Module M0622: Business Administration and Enterprise Resource Planning: CERMEDES AG

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Business Administration and Enterprise Resource Planning: CERMEDES AG (L0330) | Seminar | 2 | 3 |
| Business Administration and Enterprise Resource Planning: CERMEDES AG (L1785) | Lecture | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Christian Ringle |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basic knowledge in business administration. |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students are able to...<br>• describe an internationally active company;<br>• describe complex and interrelated business processes along the supply chain;<br>• present important aspects of the project management of enterprise resource planning software implementations;<br>• name rules and processes for the implementation of business processes in SAP;<br>• explain the functioning and use of enterprise resource planning software along the supply chain;<br>• conduct business processes in SAP on their own;<br>• present the integrative role of enterprise resource planning systems. |
| *Skills* | The students are able to...<br>• map the design of business processes along the supply chain of a firm;<br>• implement business processes in an enterprise resource planning software;<br>• use an internationally used enterprise resource planning software in a daily routine;<br>• critically evaluate the enterprise resource planning software along the theoretical requirements for optimally designing a business process. |
| **Personal Competence** | |
| *Social Competence* | The students are able to...<br>• direct fruitful and professional discussions;<br>• work in teams on exercises;<br>• present and defend results of their work;<br>• communicate and collaborate successfully and respectfully with others in teams. |
| *Autonomy* | The students will be able to acquire knowledge in a specific context independently and to map this knowledge onto other new complex problem fields. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written elaboration |
| **Examination duration and scale** | 12 pages per student; 4 months; incl. oral presentation |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Elective Compulsory<br>Logistics and Mobility: Core Qualification: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Core Qualification: Elective Compulsory |

| Course L0330: Business Administration and Enterprise Resource Planning: CERMEDES AG | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Christian Ringle |
| **Language** | EN |
| **Cycle** | WiSe |
| **Content** | The course involves two main parts:<br><br>During the first part of the course, participants are provided with insights into the market for ERP-Software and are provided with knowledge on how ERP-implementation projects proceed and how these projects should ideally be managed from a theoretical and practical perspective. In addition, participants are provided with an understanding of business functions and processes by means of visiting the TUHH model factory. In the model factory, participants and are solving special business cases on the basis of group-specific tasks. Finally, participants are introduced into the basic functioning of ERP-Software referring to the most common system (SAP). Participants gain a basic understanding of implementing organizational data, master data and processes into the system.<br><br>During the second phase of this course, the students work independently in groups on deepening challenges, which conceptually build up on the executed case studies from phase one. Using the knowledge from phase one, the students are able to transfer the theoretical knowledge on the practical execution of the challes in SAP. The results of the group work will be presented in phase two. |
| **Literature** | Participants will be provided with a course handout in the form of ppt.-slides which can be downloaded in advance. Further literature references regarding the theoretical concepts are not provided (as this is part of the challenge in writing the thesis); literature references with regard to the ERP-System used are as follows:<br><br>• Agrawal, A. (2009): Customizing Materials Management Processes in SAP ERP Operations, Galileo Press: Boston.<br>• Arif, N./Tauseef, S. (2010): Integrating SAP ERP Financials, Galileo Press: Boston.<br>• Chudy, M./Castedo, L. (2015): Sales and Distribution in SAP ERP - Practical Guide, Galileo Press: Boston.<br>• Dickersback, J. T./Keller, G. (2010): Production Planning and Control with SAP ERP, 2e, Galileo Press: Boston.<br>• Franz, M. (2014): Project Management with SAP Project System, 4e, Galileo Press: Boston.<br>• Hoppe, M./Gulyassy, F. (2009): Materials Planning with SAP, Galileo Press: Boston.<br>• Veeriah, N. (2011): Customizing Financial Accounting in SAP, Galileo Press: Boston.<br>• Veeriah, N. (2011): Financial Accounting in SAP, Galileo Press: Boston. |

| Course L1785: Business Administration and Enterprise Resource Planning: CERMEDES AG | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Christian Ringle |
| **Language** | EN |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0831: Introduction to Operations Research and Statistics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Introduction to Operations Research (L0884) | Lecture | 2 | 2 |
| Introduction to Statistics (L0883) | Lecture | 2 | 2 |
| Exercises to Introduction in Quantitative Methods in Logistics (L0885) | Recitation Section (small) | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Kathrin Fischer |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Knowledge from Mathematics Lectures. |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students know<br>• different methods from the field of descriptive statistics and can explain them and their importance for Logistics;<br>• selected discrete and continuous distribution functions and can explain their meaning and their areas of application;<br>• the laws of probability theory and can explain them;<br>• different methods of inferential statistics - e.g. confidence intervals, hypothesis testing;<br>• the history and relevance of Operations Research;<br>• linear programming methods for solving planning problems;<br>• selected methods of transportation and network optimization, e.g. methods for finding a shortest path;<br>• models and methods for the travelling salesman and the vehicle routing problem;<br>• appropriate software for solving these problems. |
| *Skills* | Students are able to<br>• collect data by appropriate methods, to aggregate, classify and analyze the data and to illustrate their results;<br>• recognize different distribution functions and to apply them in the solution of Logistics problems;<br>• apply laws of probability to construct solutions for Business problems;<br>• use appropriate methods of inferential statistics, apply them to Business problems and evaluate the results of their analysis;<br>• construct appropriate quantitative - linear or integer - models for Business planning situations;<br>• apply methods from linear programming and interpret the results;<br>• apply methods from transport and network planning and interpretthe results;<br>• solve TSPs and vehicle routing problems by heuristic methods;<br>• carry out a sensitivity analysis and evaluate the results;<br>• critically judge the different methods and their applicability;<br>• apply appropriate software for solving the problems. |
| **Personal Competence** | |
| *Social Competence* | Students are able to<br>• work successfully and respectfully in a team, derive group results and document them;<br>• engage in scientific discussions on topics from the fields of Statistics and OR;<br>• present the results of their work to others in an understandable way. |
| *Autonomy* | Students are able to<br>• carry out data analyses for given tasks independently, individually or in a team;<br>• solve complex Business planning problems independently or in a team, selecting and using appropriate software;<br>• gather knowledge in the area independently and to apply their knowledge in problem solving;<br>• critically reflect on the results of their work. |
| **Workload in Hours** | Independent Study Time 96, Study Time in Lecture 84 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 2 hours |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Core Qualification: Compulsory |

| Course L0884: Introduction to Operations Research | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Kathrin Fischer |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | 1. Introduction to Operations Research<br>2. Linear Programming and Applications<br>3. Transportation Problems<br>4. Network Problems (e.g. Shortest Paths)<br>5. Travelling Salesman Problems and Vehicle Routing |
| **Literature** | D.R. Anderson / D.J. Sweeney / T.A. Williams / Martin: Quantitative Methods for Business. 11th Edition, Thomson, South Western 2008.<br>W. Domschke / A. Drexl: Einführung in Operations Research, 7. Auflage, Springer, Berlin et al. 2007.<br>F.S. Hillier/ G.J. Lieberman: Introduction to Operations Research. 8th Edition, McGraw-Hill, 2005.<br>L. Suhl / T. Mellouli: Optimierungssysteme. Springer Verlag. Berlin et al. 2006. |

| Course L0883: Introduction to Statistics | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Kathrin Fischer |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | 1. Introduction to statistics<br>2. Basics of descriptive statistics<br>3. Methods of descriptive statistics<br>4. Probabilities<br>5. Discrete probability distrbutions and their applications<br>6. Continuous probability distrbutions and their application<br>7. Introduction to confidence intervals<br>8. Introduction to hypothesis testing<br>9. Linear regression |
| **Literature** | Bluman, Alan G.: Elementary Statistics - A brief version. Third Edition, McGrawHill 2006.<br>Bowerman, Bruce L. and O'Connell, Richard T.: Business Statistics in Practice, 4 th edition, McGraw-Hill 2007.<br>Fahrmeir, L., Künstler, R., Pigeot, I., Tutz, G.: Statistik - Der Weg zur Datenanalyse. 6. Auflage. Berlin, Heidelberg 2007.<br>Quatember, A.: Statistik ohne Angst vor Formeln. 2. Auflage. Pearson Verlag 2008.<br>Schira, J.: Statistische Methoden der VWL und BWL - Theorie und Praxis. 2. Auflage, Pearson Verlag 2005. |

| Course L0885: Exercises to Introduction in Quantitative Methods in Logistics | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Kathrin Fischer |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Interactive sessions for discussion and application of the contents of "Introduction to Statistics" and "Introduction to OR". |
| **Literature** | Literaturangaben siehe Vorlesungen<br><br>Übungsblätter und weitere Informationen werden in der Übung verteilt. |

## Module M1073: Complementary Courses in Business Administration

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Applied game theory (L2601) | Lecture | 2 | 2 |
| Introduction to Methods for Business Decision Making (L1288) | Lecture | 2 | 2 |
| Production Management and Organization (L1292) | Lecture | 2 | 2 |
| Introduction to Law (L0993) | Lecture | 2 | 2 |
| Introduction to Economics (L2712) | Lecture | 2 | 3 |
| Entrepreneurship (L0753) | Lecture | 2 | 2 |
| Law for Engineers (L1133) | Lecture | 2 | 2 |
| Corporate Strategies (L0160) | Lecture | 2 | 2 |
| Civil- & Business Law (L1132) | Lecture | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Heike Flämig |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • Students are able to find their way around selected special areas of management within the scope of business management.<br>• Students are able to explain basic categories and models in selected special areas of business management.<br>• Students are able to interrelate technical and management knowledge. |
| *Skills* | • Students are able to apply basic methods in selected areas of business management. |
| **Personal Competence** | |
| *Social Competence* | -- |
| *Autonomy* | Students can chose independently, in which field the want to deepen their knowledge and skills through the election of courses. |
| **Workload in Hours** | Depends on choice of courses |
| **Credit points** | 6 |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory |

### Course L2601: Applied game theory

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 60 min |
| **Lecturer** | Dr. Christina Strobel |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • Game theory comprises models of strategic interaction, i.e. situations in which one's optimal choices depend on the choices of others. The lecture gives an introduction to game theory focusing on applications in economics and business administration.<br>• The module will be taught as online lecture via Zoom. It will contain lecture elements that are supplemented by videos and group work.<br>• The language of instruction is German. |
| **Literature** | • Gibbons, R.S. (1992) "A Primer in Game Theory", FT Prentice Hall. |

| Course L1288: Introduction to Methods for Business Decision Making | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 60 min |
| **Lecturer** | Dr. Ines Krebs-Zerdick |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Recommended Previous Knowledge:<br>Modules BWL I and BWL II<br><br>Contents:<br>1. Problem analysis, structuring and formulation<br>2. Planning analyses & Generating data<br>3. Solving problems: Analysis and decision<br>• Decisions under singular and multiple objectives<br>• Decisions under uncertainty and risk<br>4. Bounded rationality and psychological traps<br>5. Implementing decisions<br>• Communication of analyses and decisions<br>• Achieving sustainable impact of decisions<br>• The influence of a company's culture, organization and management styles on decision making processes<br><br>Learning Outcomes:<br>The aim of this lecture is for the students to learn how to structure and model complex decision situations, and how to analyse and solve the resulting problems. Especially, they should be able to apply the knowledge they gain to practical decision situations from the field of business and management.<br><br>In particular, after successful completion of this module, students should be able to<br>• Analyse and structure decision situations<br>• Apply structured methods for generating alternatives<br>• Develop and analyse goals and systems of goals<br>• Solve specific decision problems, as, e.g., problems with multiple objectives or probles under risk, by suitable methods<br>• Take into account psychological traps and their effect on decision makers<br><br>Moreover, students should be able to comment on the limitations of the different approaches and develop own ideas for solving complex problems. Students should be able to see decisions in the context of business realities and<br>• make a judgement on the resources required for decision making and factor them into the choice of a suitable problem solving approach<br>• treat implementation of decisions systematically as part of the problem solving process<br>• understand how decision making processes in companies can be shaped and influence business success |
| **Literature** | Eisenführ, F., Weber, M.: Rationales Entscheiden, 5. Auflage, Springer-Verlag, Berlin et al. 2010.<br><br>Weitere Literaturhinweise werden in der Veranstaltung gegeben./ Further current bibliography will be given in lecture.<br><br>will be given in lecture. |

| Course L1292: Production Management and Organization | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 60 min |
| **Lecturer** | Prof. Hermann Lödding |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | 1. Leadership 2. Communication 3. Management of the key performance indicators 4. Methods 5. Strategies |
| **Literature** | Vorlesungsskript |

| Course L0993: Introduction to Law | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 2 h |
| **Lecturer** | Klaus-Ulrich Tempke |
| **Language** | DE |
| **Cycle** | WiSe/SoSe |
| **Content** | Recommended Prior Knowledge / Requirements:<br>Students are required to have their own copy of the "Bürgerliches Gesetzbuch (BGB)" for lectures and written exam<br>Discussion Topics:<br>Discussion of jurisdictions with different stages of appeal and members of the courts, mainly in the area of civil law;<br>Difference between a statement of claim, default summon and writ of execution in adjective law;<br>Different levels of legal capacity (full and restricted) as well the determination of criminal ability;<br>Development of a contract and discussion of different types of contracts;<br>Implications of challenges and representations in conclusions of a contracU<br>Contract extensions, statutory limitations and the implications of an event of default.<br>Learning targets:<br>Introduction to "legal thinking" and gathering a basic understanding of the different stages of a court process.<br>Key aspects of a contract, including representations, implications of defaults, extensions and statutory limitations.<br>Required Reading:<br>Supplemental materials will be provided during lectures (other than BGB copy above) |
| **Literature** | Begleitende Unterrichtsmaterialien werden verteilt. / Current bibliography will be given in lecture. |

| Course L2712: Introduction to Economics | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 60 min |
| **Lecturer** | Prof. Timo Heinrich |
| **Language** | EN |
| **Cycle** | WiSe |
| **Content** | • Capitalism and democracy: Affluence, inequality and the environment<br>• Social interactions and economic outcomes<br>• Public policy for fairness and efficiency<br>• Work, wellbeing and scarcity<br>• Institutions, power and inequality<br>• The firm: Employees, managers and owners<br>• Firms and markets for goods and services<br>• The credit market: Borrowers, lenders and the rate of interest<br>• Banks, money, housing and financial assets<br>• Market failures<br>• Governments and markets in a democratic society |
| **Literature** | • The CORE Team: Economy, Society and Public Policy, Oxford University Press, 2019<br>• Mankiw/Taylor: Economics, Cengage, 5th ed., 2020<br>• Wheelan: Naked Economics, 3rd ed. Norton, 2019 |

| Course L0753: Entrepreneurship | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 2 midterm Klausuren (jeweils 15 Minuten) und eine Abschlussklausur (60 Minuten) |
| **Lecturer** | Prof. Christian Lüthje |

| | |
|---|---|
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | **General description of course content and course goals**<br><br>The course aims at preparing students for a potential career as an entrepreneur. It starts with theoretical foundations of entrepreneurship and the impact of new ventures on innovation, technological progress and economic development. In the following sessions on business planning, students learn which strategic entrepreneurial decisions have to be made by entrepreneurs. They get to know how to develop and evaluate business ideas and business models, how to write a business plan, and how to obtain financing. Additionally, the course includes lessons about managing the new venture in the post-formation phase (especially on marketing and organizational development). The course content is based on recent results of entrepreneurship research, real-life examples, and also includes guest lectures from entrepreneurial practice.<br><br>**Summarizing the most important contents**<br><br>The course provides answers to the following fundamental questions of entrepreneurship theory and practice:<br><br>• Which constituent elements define an entrepreneur?<br>• Which specific personality traits and behaviors are attributed to entrepreneurs?<br>• How can we describe and structure the new venture formation process?<br>• What are critical success factors of entrepreneurs and what are potential barriers to success?<br>• What are the latest developments of entrepreneurship in Germany, the economic meaning of new ventures, and the role of political and educational support and funding?<br>• How can we develop and evaluate business ideas and business models?<br>• Which strategic decisions have to be made by entrepreneurs in the business planning process (regarding law and taxation, market analysis, growth strategies, location, networks, and strategic partnerships)?<br>• What makes a good business plan and how to obtain new venture financing?<br>• How to manage the new venture in the post-formation phase (leadership, entrepreneurial team, marketing, and organizational development)?<br><br>**Knowledge**<br><br>Students can...<br><br>• Understand what an entrepreneur is and which economic impact entrepreneurship has.<br>• Define fundamental terms and explain important theories in entrepreneurship research.<br>• Analyze key decisions in important areas of entrepreneurship and new venture management (e.g. financing, marketing, team formation).<br>• Evaluate business ideas, business models, and business plans.<br>• Make connections between different entrepreneurial areas of decision making in the pre- and post-foundation phase of a new venture and analyze potential reciprocal effects.<br><br>**Skills**<br><br>Students are capable of...<br><br>• Simultaneously considering multiple factors and taking reasoned actions in entrepreneurial decision-making (Idea generation and evaluation, business planning, financing, law and taxation, market analysis, growth strategies, location, networks, and strategic partnerships).<br>• Making well-grounded decisions regarding main functional business areas in realistic entrepreneurial situations (marketing, leadership, organization, entrepreneurial team, organizational development).<br><br>**Social Competence**<br><br>Students can...<br><br>• Provide appropriate feedback and handle feedback on their own performance constructively.<br>• Enter into a dialogue with formerly unknown fellow students, participate in discussions, and present well-grounded arguments.<br>• Constructively interact with guest speakers and learn from their practical experiences.<br><br>**Self-Reliance**<br><br>Students are able to...<br><br>• Evaluate consequences of a potential career as entrepreneur and state pros and cons of being an entrepreneur.<br>• Specify own strengths and weaknesses with regard to general entrepreneurial tasks in the new venture process.<br>• Justify and make decisions in entrepreneurial situations with the help from teachers as well as define tasks and acquire relevant knowledge. |
| **Literature** | Kuratko, Donald F. (2009): Introduction to Entrepreneurship, 8th Edition, Cengage Learning<br><br>Kuratko, Donald F. and Hodgetts, Richard M. (2007): Entrepreneurship - Theory, Process Practice, Thomson South-Western<br><br>Fueglistaller, Urs; Müller, Christoph; Müller, Susan und Volery, Thierry (2012): Entrepreneurship<br><br>Modelle - Umsetzung - Perspektiven Mit Fallbeispielen aus Deutschland, Österreich und der Schweiz, Gabler<br><br>A. Osterwalder, Yves Pigneur (2010): Business Model Generation |

| Course L1133: Law for Engineers | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 90 Minuten |
| **Lecturer** | Markus A. Meyer-Chory |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • Refreshment: Basics of Law<br>• Legal relevance of Engineers cases and actions: Contract Law, Liabilities - also for products, labor law, patent law, companies law |
| **Literature** | **Notwendiger Gesetzestext (in Klausur erlaubt):**<br><br>**Bürgerliches Gesetzbuch 72. Auflage , 2013 , dtv Beck-Texte 5001, ISBN 978-3-406-65707-8**<br><br>**Empfohlene Gesetzestexte:Arbeitsgesetze 83. Auflage, 2013 dtv Beck-Texte 5006 ISBN 978-3-406-65689-7**<br>**Handelsgesetzbuch 54. Auflage, 2013** dtv Beck Texte 5002 ISBN 978-3-406-65083-3<br>**Gesellschaftsrecht, 13. Auflage , 2013** dtv Beck Texte 5585 ISBN 978-3-406-64502-0<br>**Wettbewerbsrecht, Markenrecht und Kartellrecht , 33. Auflage, 2013** dtv Beck Texte ISBN 978-3-406-65212-7<br><br>**Empfohlene Literatur:**<br><br>**Vock, Willi,** Recht der Ingenieure, 1. Auflage 2012, Boorberg Verlag , ISBN-10:3-415-04535-8 --- EAN:9783415045354<br><br>**Meurer** Rechtshandbuch für Architekten und Ingenieure 1...Auflage -- erscheint Anfg 2014 Werner Verlag ISBN 978-3-8041-4342-5<br>**Eisenberg / Gildeggen / Reuter / Willburger** Produkthaftung 2. Auflage - erscheint Anfg 2014 Oldenbourg Verlag - ISBN 978-3-486-71324-4<br>**ENDERS/HETGER,** Grundzüge der betrieblichen Rechtsfragen, 4. Auflage, 2008 Richard Boorberg Verlag - ISBN 978-3-415-04005-2<br>**Müssig, Peter,** Wirtschaftsprivatrecht, 15. Auflage, 2012 , C.F. Müller UTB - ISBN 978-3-81149476-3<br>**Schade, Friedrich,** Wirtschaftsprivatrecht, 2. Auflage 2009, Kohlhammer - ISBN 978-3-17-021087-5 |

| Course L0160: Corporate Strategies | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 60 Minuten |
| **Lecturer** | Prof. Thomas Wrona |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Introduction to the theory and practice of strategic management:<br><br>The major will be on different types of corporate strategies of selected methods for the analysis of external and internal factors affecting the company and the strategic management process. The acquired knowledge is practically applied on the basis of selected case studies in the lectures to make students familiar with the use and application of different analysis techniques. A guest speaker complements the content of the lecture by providing a practical perspective on strategic management. |
| **Literature** | Bamberger, I. and T. Wrona (1996). "Der Ressourcenansatz und seine Bedeutung für die strategische Unternehmensführung." Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung (zfbf) 48 (2): 130-153.<br><br>Bamberger, I. and T. Wrona (2004). Strategische Unternehmensführung. Strategien, Systeme, Prozesse. München, Vahlen.<br><br>Johnson, G., K. Scholes, et al. (2006). Exploring corporate strategy. Text and cases. Harlow, Financial Times Prentice Hall.<br><br>Mintzberg, H. (1987). "The Strategy Concept I: Five Ps for Strategy." California Management Review(Fall): 11-24.<br><br>Müller-Stewens, G. and C. Lechner (2005). Strategisches Management - Wie strategische Initiativen zum Wandel führen. Stuttgart.<br><br>Porter, M. E. (1980). Competitive strategy. Techniques for analyzing industries and competitors New York, Free Press.<br><br>Porter, M. E. (1997). Wettbewerbsstrategie - Methoden zur Analyse von Branchen und Konkurrenten. Frankfurt a.M.<br><br>Steinmann, H. and G. Schreyögg (2005). Management - Grundlagen der Unternehmensführung. Wiesbaden, Gabler.<br><br>Welge, M. K. and A. Al-Laham (2008). Strategisches Management. Grundlagen - Prozess - Implementierung. Wiesbaden, Gabler.<br><br>Wheelen, T. L. and D. J. Hunger (2012). Strategic management and business policy. Toward global sustainability. Boston/Columbus et al., Pearson. |

| Course L1132: Civil- & Business Law | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Examination Form** | Klausur |
| **Examination duration and scale** | 90 Minuten |
| **Lecturer** | Markus A. Meyer-Chory |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | - Basics of German Law System<br><br>- Basic concepts and Systematics of Civil-, Commercial-, Companies- and Labor Law by specific bullet points, i.e. Insurance law, etc. |
| **Literature** | folgt im Seminar |

## Module M0594: Fundamentals of Mechanical Engineering Design

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Fundamentals of Mechanical Engineering Design (L0258) | Lecture | 2 | 3 |
| Fundamentals of Mechanical Engineering Design (L0259) | Recitation Section (large) | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Dieter Krause |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | • Basic knowledge about mechanics and production engineering<br>• Internship (Stage I Practical) |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | After passing the module, students are able to:<br>• explain basic working principles and functions of machine elements,<br>• explain requirements, selection criteria, application scenarios and practical examples of basic machine elements, indicate the background of dimensioning calculations. |
| *Skills* | After passing the module, students are able to:<br>• accomplish dimensioning calculations of covered machine elements,<br>• transfer knowledge learned in the module to new requirements and tasks (problem solving skills),<br>• recognize the content of technical drawings and schematic sketches,<br>• technically evaluate basic designs. |
| **Personal Competence** | |
| *Social Competence* | • Students are able to discuss technical information in the lecture supported by activating methods. |
| *Autonomy* | • Students are able to independently deepen their acquired knowledge in exercises.<br>• Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of the lectures. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Core Qualification: Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Green Technologies: Energy, Water, Climate: Specialisation Energy Technology: Elective Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Orientation Studies: Core Qualification: Elective Compulsory<br>Naval Architecture: Core Qualification: Compulsory<br>Technomathematics: Specialisation III. Engineering Science: Elective Compulsory |

| Course L0258: Fundamentals of Mechanical Engineering Design | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Dieter Krause, Prof. Josef Schlattmann, Prof. Otto von Estorff, Prof. Sören Ehlers |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | **Lecture**<br>• Introduction to design<br>• Introduction to the following machine elements<br>  ◦ Screws<br>  ◦ Shaft-hub joints<br>  ◦ Rolling contact bearings<br>  ◦ Welding / adhesive / solder joints<br>  ◦ Springs<br>  ◦ Axes & shafts<br>• Presentation of technical objects (technical drawing)<br>**Exercise**<br>• Calculation methods for dimensioning the following machine elements:<br>  ◦ Screws<br>  ◦ Shaft-hub joints<br>  ◦ Rolling contact bearings<br>  ◦ Welding / adhesive / solder joints<br>  ◦ Springs<br>  ◦ Axis & shafts |
| **Literature** | • Dubbel, Taschenbuch für den Maschinenbau; Grote, K.-H., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.<br>• Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.<br>• Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.<br>• Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.<br>• Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.<br>• Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.<br>• Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.<br>• Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.<br>• Sowie weitere Bücher zu speziellen Themen |

| Course L0259: Fundamentals of Mechanical Engineering Design | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Dieter Krause, Prof. Josef Schlattmann, Prof. Otto von Estorff, Prof. Sören Ehlers |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0986: Introduction to Transportation Economics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Introduction to Transportation Economics (L1188) | Lecture | 3 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Heike Flämig |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to...<br>• explain basic connections between transport, traffic and logistics<br>• explain the macroeconomic relevance of logistics<br>• state the relevance of different modes of transport for the economy<br>• describe the development and challenges of transport policy<br>• explain trends and developments in transport industry |
| *Skills* | Based on their gained knowledge students can develop ideas for political decisions and design questions in the transport industry. |
| **Personal Competence** | |
| *Social Competence* | Students can discuss small tasks in groups and find solutions together. |
| *Autonomy* | Students are able to solve small tasks on their own with given literature. |
| **Workload in Hours** | Independent Study Time 138, Study Time in Lecture 42 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 60 minutes |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Compulsory |

### Course L1188: Introduction to Transportation Economics

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 3 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 138, Study Time in Lecture 42 |
| **Lecturer** | Karl Michael Probst |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | • Functions of transport<br>• Macroeconomic developments of transport<br>• Special characteristics of transport<br>• Transport infrastructure policy<br>• International transport policy<br>• Transport policy in the EU<br>• External costs of transport<br>• Market entry into transport markets |
| **Literature** | -- |

## Module M1693: Computer Science for Engineers - Programming Concepts, Data Handling & Communication

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Computer Science for Engineers - Programming Concepts, Data Handling & Communication (L2689) | Lecture | 3 | 3 |
| Computer Science for Engineers - Programming Concepts, Data Handling & Communication (L2690) | Recitation Section (small) | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Sibylle Fröschle |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence**<br>*Knowledge*<br>*Skills*<br><br>**Personal Competence**<br>*Social Competence*<br>*Autonomy* | |
| **Workload in Hours** | Independent Study Time 110, Study Time in Lecture 70 |
| **Credit points** | 6 |
| **Course achievement** | Compulsory: No; Bonus: 10 %; Form: Attestation; Description: Testate finden semesterbegleitend statt. |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Green Technologies, Focus Renewable Energy: Elective Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Elective Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Elective Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Green Technologies, Focus Renewable Energy: Elective Compulsory<br>Bioprocess Engineering: Core Qualification: Compulsory<br>Electrical Engineering: Core Qualification: Compulsory<br>Energy and Environmental Engineering: Core Qualification: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Elective Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Elective Compulsory<br>Green Technologies: Energy, Water, Climate: Specialisation Energy Systems: Elective Compulsory<br>Logistics and Mobility: Core Qualification: Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Process Engineering: Core Qualification: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Compulsory |

### Course L2689: Computer Science for Engineers - Programming Concepts, Data Handling & Communication

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 3 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 48, Study Time in Lecture 42 |
| **Lecturer** | Prof. Sibylle Fröschle |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | |
| **Literature** | John V. Guttag: Introduction to Computation and Programming Using Python.<br>With Application to Understanding Data. 2nd Edition. The MIT Press, 2016. |

| Course L2690: Computer Science for Engineers - Programming Concepts, Data Handling & Communication | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Sibylle Fröschle |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0974: Business Simulation Marktstrat

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Business Simulation Marktstrat (L0918) | Seminar | 4 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Christian Lüthje |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to...<br>• recognize and analyze relationships and interdependencies between different decision areas in business management<br>• understand problem-related terms, theories and methods of business administration and relate these to practical situations in businesses |
| *Skills* | Students are able to...<br>• make well-founded decisions in realistic coroporate settings by drawing on the business administration knowledge<br>• consider in parallel and balance several relevant factors when making business-related decisions (e.g. financial situation, behavior of competitors, market demand, production capacities)<br>• critically analyze business decisions in hindsight and deduce consequences for future decisions from this analysis<br>• analyze and explain phenomena from daily business by drawing on business administration theories and methods |
| **Personal Competence** | |
| *Social Competence* | Students are able to...<br>• form stable work groups with fellow students, even those, who were previously unknown, and agree on work habits<br>• arrive at a consensus as a team when making management decisions and, if necessary, to solve conflicts along the way to achieving the consensus<br>• adequately present the situation of a (fictitious) company and their decision making to teachers and fellow students |
| *Autonomy* | Students are able to...<br>• make and justify decisions in simulated professional situations<br>• reflect their own actions in hindsight and arrive at suggestions for improvements in a structured way<br>• critically depict and reflect situations in a structured way, both, orally as well as in written reports<br>• make transfers from theory into practice |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Subject theoretical and practical work |
| **Examination duration and scale** | different achievements (single/team) - learning diary, presentations, reflections |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Elective Compulsory<br>Logistics and Mobility: Core Qualification: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Core Qualification: Elective Compulsory |

| Course L0918: Business Simulation Marktstrat | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 4 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Lecturer** | Prof. Christian Lüthje |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | The business simulation game Markstrat B2B - Markstrat is a business simulation which puts you into the role of managing the marketing division of the electro-mechanical business unit of a large corporation. Competing with several other companies, you try to successfully market two products to business customers. To this end, you and other students jointly develop and implement a long-term marketing strategy for your business unit.<br><br>During the 10 rounds of the simulation game, the students and the randomly assigned student team make decisions in the areas of product development, advertising, sales, price, production, and human resources on a weekly basis. To make well-informed decisions, the student teams can draw on a large number of information sources such as customer surveys, experiments, market studies, and benchmarks which you need to analyze during each round of the simulation.<br><br>The simulation is accompanied by a comprehensive introduction, a concomitant coaching, as well as a mid-term and final presentation. In addition, the student teams will prepare a written report. |
| **Literature** | Kotler, Philip und Keller, Kevin Lane (2011): Marketing Management, 14th Edition, Prentice Hall International<br><br>Morris, Michael H.; Pitt, Leyland F.; Honeycutt Jr., Earl D. (2001): Business-To-Business Marketing: A Strategic Approach, 3rd Edition, Sage<br><br>Bruhn, Manfred (2012): Marketing - Grundlagen für Studium und Praxis, 11. Auflage, Gabler |

## Module M0681: Project Course Logistics and Mobility

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|

| | |
|---|---|
| **Module Responsible** | Dozenten des Studiengangs |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students will receive in-depth knowledge and in-depth skills in a special area of business administration, engineering science, logistics or mobility and can reproduce this knowledge. |
| *Skills* | After the project work in a business, engineering related, logistics and or mobility related research field, students are able to...<br>• familiarize themselves with a scientific and/or application-oriented problem<br>• analyze the problem and find a solution (if appropriate as part of a team)<br>• to refer to appropriate literature for the work on a problem as well as to critically evaluate publications<br>• produce a scientifically sound written report on the problem in question (if appropriate as part of a team) |
| **Personal Competence** | |
| *Social Competence* | After the project work students are able to...<br>• work respectfully in teams and to organize themselves in teams<br>• analyse a problem in a team and to find a solution together<br>• present and defend their project work to a sizable (expert) audience |
| *Autonomy* | After the project work students are able to...<br>• familiarize themselves successfully with a demanding scientific or application oriented problem independently<br>• prepare and deliver a presentation of their results independently |
| **Workload in Hours** | Independent Study Time 180, Study Time in Lecture 0 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Study work |
| **Examination duration and scale** | |
| **Assignment for the Following Curricula** | Logistics and Mobility: Core Qualification: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Core Qualification: Compulsory |

## Specialization Engineering Science

Students learn the basics of technical mechanics, electrical and construction engineering. By electing at least two electives according to their individual interests, students can deepen their knwoledge and skills in different areas of engineering science. The gained knowledge and skills enables Students to understand and design technological systems in the field of logistics and mobility.

### Module M0725: Production Engineering

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Production Engineering I (L0608) | Lecture | 2 | 2 |
| Production Engineering I (L0612) | Recitation Section (large) | 1 | 1 |
| Production Engineering II (L0610) | Lecture | 2 | 2 |
| Production Engineering II (L0611) | Recitation Section (large) | 1 | 1 |

| | |
|---|---|
| **Module Responsible** | Prof. Wolfgang Hintze |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | no course assessments required<br><br>internship recommended |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to ...<br><br>• name basic criteria for the selection of manufacturing processes.<br>• name the main groups of Manufacturing Technology.<br>• name the application areas of different manufacturing processes.<br>• name boundaries, advantages and disadvantages of the different manufacturing process.<br>• describe elements, geometric properties and kinematic variables and requirements for tools, workpiece and process.<br>• explain the essential models of manufacturing technology. |
| *Skills* | Students are able to...<br><br>• select manufacturing processes in accordance with the requirements.<br>• design manufacturing processes for simple tasks to meet the required tolerances of the component to be produced.<br>• assess components in terms of their production-oriented construction. |
| **Personal Competence** | |
| *Social Competence* | Students are able to ...<br><br>• develop solutions in a production environment with qualified personnel at technical level and represent decisions. |
| *Autonomy* | Students are able to ..<br><br>• interpret independently the manufacturing process.<br>• assess own strengths and weaknesses in general.<br>• assess their learning progress and define gaps to be improved.<br>• assess possible consequences of their actions. |
| **Workload in Hours** | Independent Study Time 96, Study Time in Lecture 84 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Elective Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Engineering Science: Specialisation Mechanical Engineering: Compulsory<br>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: Compulsory<br>Green Technologies: Energy, Water, Climate: Specialisation Energy Technology: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Compulsory<br>Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Compulsory |

| Course L0608: Production Engineering I | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Wolfgang Hintze |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • Manufacturing Accuracy<br>• Manufacturing Metrology<br>• Measurement Errors and Uncertainties<br>• Introduction to Forming<br>• Massiv forming and Sheet Metal Forming<br>• Introduction to Machining Technology<br>• Geometrically defined machining (Turning, milling, drilling, broaching, planning) |
| **Literature** | Dubbel, Heinrich (Grote, Karl-Heinrich.; Feldhusen, Jörg.; Dietz, Peter,; Ziegmann, Gerhard,;) Taschenbuch für den Maschinenbau : mit Tabellen. Berlin [u.a.] : Springer, 2007<br><br>Fritz, Alfred Herbert: Fertigungstechnik : mit 62 Tabellen. Berlin [u.a.] : Springer, 2004<br><br>Keferstein, Claus P (Dutschke, Wolfgang,;): Fertigungsmesstechnik : praxisorientierte Grundlagen, moderne Messverfahren. Wiesbaden : Teubner, 2008<br><br>Mohr, Richard: Statistik für Ingenieure und Naturwissenschaftler : Grundlagen und Anwendung statistischer Verfahren. Renningen : expert-Verl, 2008<br><br>Klocke, F., König, W.: Fertigungsverfahren Bd. 1 Drehen, Fäsen, Bohren. 8. Aufl., Springer (2008)<br><br>Klocke, Fritz (König, Wilfried,;): Umformen. Berlin [u.a.] : Springer, 2006<br><br>Paucksch, E.: Zerspantechnik, Vieweg-Verlag, 1996<br><br>Tönshoff, H.K.; Denkena, B., Spanen. Grundlagen, Springer-Verlag (2004) |

| Course L0612: Production Engineering I | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Wolfgang Hintze |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L0610: Production Engineering II | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Wolfgang Hintze, Prof. Claus Emmelmann |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | • Geometrically undefined machining (grinding, lapping, honing)<br>• Introduction into erosion technology<br>• Introduction into blastig processes<br>• Introduction to the manufacturing process forming (Casting, Powder Metallurgy, Composites)<br>• Fundamentals of Laser Technology<br>• Process versions and Fundamentals of Laser Joining Technology |
| **Literature** | Klocke, F., König, W.: Fertigungsverfahren Bd. 2 Schleifen, Honen, Läppen, 4. Aufl., Springer (2005)<br><br>Klocke, F., König, W.: Fertigungsverfahren Bd. 3 Abtragen, Generieren und Lasermaterialbearbeitung. 4. Aufl., Springer (2007)<br><br>Spur, Günter (Stöferle, Theodor.;): Urformen. München [u.a.] : Hanser, 1981<br><br>Schatt, Werner (Wieters, Klaus-Peter,; Kieback, Bernd,;): Pulvermetallurgie : Technologien und Werkstoffe. Berlin [u.a.] : Springer, 2007 |

| Course L0611: Production Engineering II | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Wolfgang Hintze, Prof. Claus Emmelmann |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0575: Procedural Programming

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Procedural Programming (L0197) | Lecture | 1 | 2 |
| Procedural Programming (L0201) | Recitation Section (large) | 1 | 1 |
| Procedural Programming (L0202) | Practical Course | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Siegfried Rump |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Elementary PC handling skills<br>Elementary mathematical skills |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students acquire the following knowledge:<br>• They know basic elements of the programming language C. They know the basic data types and know how to use them.<br>• They have an understanding of elementary compiler tasks, of the preprocessor and programming environment and know how those interact.<br>• They know how to bind programs and how to include external libraries to enhance software packages.<br>• They know how to use header files and how to declare function interfaces to create larger programming projects.<br>• The acquire some knowledge how the program interacts with the operating system. This allows them to develop programs interacting with the programming environment as well.<br>• They learnt several possibilities how to model and implement frequently occurring standard algorithms. |
| *Skills* | • The students know how to judge the complexity of an algorithms and how to program algorithms efficiently.<br>• The students are able to model and implement algorithms for a number of standard functionalities. Moreover, they are able to adapt a given API. |
| **Personal Competence** | |
| *Social Competence* | The students acquire the following skills:<br>• They are able to work in small teams to solve given weekly tasks, to identify and analyze programming errors and to present their results.<br>• They are able to explain simple phenomena to each other directly at the PC.<br>• They are able to plan and to work out a project in small teams.<br>• They communicate final results and present programs to their tutor. |
| *Autonomy* | • The students take individual examinations as well as a final written examn to prove their programming skills and ability to solve new tasks.<br>• The students have many possibilities to check their abilities when solving several given programming exercises.<br>• In order to solve the given tasks efficiently, the students have to split those appropriately within their group, where every student solves his or her part individually. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 90 minutes |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory |

| Course L0197: Procedural Programming | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 1 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 46, Study Time in Lecture 14 |
| **Lecturer** | Prof. Siegfried Rump |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • basic data types (integers, floating point format, ASCII-characters) and their dependencies on the CPU architecture<br>• advanced data types (pointers, arrays, strings, structs, lists)<br>• operators (arithmetical operations, logical operations, bit operations)<br>• control flow (choice, loops, jumps)<br>• preprocessor directives (macros, conditional compilation, modular design)<br>• functions (function definitions/interface, recursive functions, "call by value" versus "call by reference", function pointers)<br>• essential standard libraries and functions (stdio.h, stdlib.h, math.h, string.h, time.h)<br>• file concept, streams<br>• basic algorithms (sorting functions, series expansion, uniformly distributed permutation)<br>• exercise programs to deepen the programming skills |
| **Literature** | **Kernighan, Brian W** (Ritchie, Dennis M.;)<br>The C programming language<br>ISBN: 9780131103702<br>*Upper Saddle River, NJ [u.a.] : Prentice Hall PTR, 2009*<br><br>**Sedgewick, Robert**<br>Algorithms in C<br>ISBN: 0201316633<br>*Reading, Mass. [u.a.] : Addison-Wesley, 2007*<br><br>**Kaiser, Ulrich** (Kecher, Christoph.;)<br>C/C++: Von den Grundlagen zur professionellen Programmierung<br>ISBN: 9783898428392<br>*Bonn : Galileo Press, 2010*<br><br>**Wolf, Jürgen**<br>C von A bis Z : das umfassende Handbuch<br>ISBN: 3836214113<br>*Bonn : Galileo Press, 2009* |

| Course L0201: Procedural Programming | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Siegfried Rump |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L0202: Procedural Programming | |
|---|---|
| **Typ** | Practical Course |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Siegfried Rump |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0833: Introduction to Control Systems

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Introduction to Control Systems (L0654) | Lecture | 2 | 4 |
| Introduction to Control Systems (L0655) | Recitation Section (small) | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Herbert Werner |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Representation of signals and systems in time and frequency domain, Laplace transform |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second order systems<br>• They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus<br>• They can explain the Nyquist stability criterion and the stability margins derived from it.<br>• They can explain the role of the phase margin in analysis and synthesis of control loops<br>• They can explain the way a PID controller affects a control loop in terms of its frequency response<br>• They can explain issues arising when controllers designed in continuous time domain are implemented digitally |
| *Skills* | • Students can transform models of linear dynamic systems from time to frequency domain and vice versa<br>• They can simulate and assess the behavior of systems and control loops<br>• They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules<br>• They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques<br>• They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation<br>• They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks |
| **Personal Competence** | |
| *Social Competence* | Students can work in small groups to jointly solve technical problems, and experimentally validate their controller designs |
| *Autonomy* | Students can obtain information from provided sources (lecture notes, software documentation, experiment guides) and use it when solving given problems.<br><br>They can assess their knowledge in weekly on-line tests and thereby control their learning progress. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Core Qualification: Compulsory<br>Bioprocess Engineering: Core Qualification: Compulsory<br>Chemical and Bioprocess Engineering: Core Qualification: Compulsory<br>Data Science: Core Qualification: Elective Compulsory<br>Data Science: Specialisation II. Application: Elective Compulsory<br>Electrical Engineering: Core Qualification: Compulsory<br>Energy and Environmental Engineering: Core Qualification: Compulsory<br>Green Technologies: Energy, Water, Climate: Core Qualification: Compulsory<br>Computer Science in Engineering: Core Qualification: Compulsory<br>Integrated Building Technology: Core Qualification: Elective Compulsory<br>Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Technomathematics: Specialisation III. Engineering Science: Elective Compulsory<br>Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory<br>Process Engineering: Core Qualification: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory |

| Course L0654: Introduction to Control Systems | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 92, Study Time in Lecture 28 |
| **Lecturer** | Prof. Herbert Werner |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | Signals and systems<br>• Linear systems, differential equations and transfer functions<br>• First and second order systems, poles and zeros, impulse and step response<br>• Stability<br>Feedback systems<br>• Principle of feedback, open-loop versus closed-loop control<br>• Reference tracking and disturbance rejection<br>• Types of feedback, PID control<br>• System type and steady-state error, error constants<br>• Internal model principle<br>Root locus techniques<br>• Root locus plots<br>• Root locus design of PID controllers<br>Frequency response techniques<br>• Bode diagram<br>• Minimum and non-minimum phase systems<br>• Nyquist plot, Nyquist stability criterion, phase and gain margin<br>• Loop shaping, lead lag compensation<br>• Frequency response interpretation of PID control<br>Time delay systems<br>• Root locus and frequency response of time delay systems<br>• Smith predictor<br>Digital control<br>• Sampled-data systems, difference equations<br>• Tustin approximation, digital implementation of PID controllers<br>Software tools<br>• Introduction to Matlab, Simulink, Control toolbox<br>• Computer-based exercises throughout the course |
| **Literature** | • Werner, H., Lecture Notes „Introduction to Control Systems“<br>• G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009<br>• K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010<br>• R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010 |

| Course L0655: Introduction to Control Systems | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Herbert Werner |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0933: Fundamentals of Materials Science

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Fundamentals of Materials Science I (L1085) | Lecture | 2 | 2 |
| Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites) (L0506) | Lecture | 2 | 2 |
| Physical and Chemical Basics of Materials Science (L1095) | Lecture | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Jörg Weißmüller |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Highschool-level physics, chemistry und mathematics |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students have acquired a fundamental knowledge on metals, ceramics and polymers and can describe this knowledge comprehensively. Fundamental knowledge here means specifically the issues of atomic structure, microstructure, phase diagrams, phase transformations, corrosion and mechanical properties. The students know about the key aspects of characterization methods for materials and can identify relevant approaches for characterizing specific properties. They are able to trace materials phenomena back to the underlying physical and chemical laws of nature. |
| *Skills* | The students are able to trace materials phenomena back to the underlying physical and chemical laws of nature. Materials phenomena here refers to mechanical properties such as strength, ductility, and stiffness, chemical properties such as corrosion resistance, and to phase transformations such as solidification, precipitation, or melting. The students can explain the relation between processing conditions and the materials microstructure, and they can account for the impact of microstructure on the material's behavior. |
| **Personal Competence** | |
| *Social Competence* | - |
| *Autonomy* | - |
| **Workload in Hours** | Independent Study Time 96, Study Time in Lecture 84 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 180 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Advanced Materials: Compulsory<br>Data Science: Specialisation II. Application: Elective Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Green Technologies: Energy, Water, Climate: Specialisation Energy Technology: Elective Compulsory<br>Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Mechanical Engineering: Core Qualification: Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Naval Architecture: Core Qualification: Compulsory<br>Technomathematics: Specialisation III. Engineering Science: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory |

### Course L1085: Fundamentals of Materials Science I

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Jörg Weißmüller |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | |
| **Literature** | Vorlesungsskript<br><br>W.D. Callister: Materials Science and Engineering - An Introduction. 5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7<br><br>P. Haasen: Physikalische Metallkunde. Springer 1994 |

| Course L0506: Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites) | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Bodo Fiedler, Prof. Gerold Schneider |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Chemische Bindungen und Aufbau von Festkörpern; Kristallaufbau; Werkstoffprüfung; Schweißbarkeit; Herstellung von Keramiken; Aufbau und Eigenschaften der Keramik; Herstellung, Aufbau und Eigenschaften von Gläsern; Polymerwerkstoffe, Makromolekularer Aufbau; Struktur und Eigenschaften der Polymere; Polymerverarbeitung; Verbundwerkstoffe |
| **Literature** | Vorlesungsskript<br><br>W.D. Callister: Materials Science and Engineering -An Introduction-5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7 |

| Course L1095: Physical and Chemical Basics of Materials Science | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Gregor Vonbun-Feldbauer |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | • Motivation: „Atoms in Mechanical Engineering?“<br>• Basics: Force and Energy<br>• The electromagnetic Interaction<br>• „Detour“: Mathematics (complex e-funktion etc.)<br>• The atom: Bohr's model of the atom<br>• Chemical bounds<br>• The multi part problem: Solutions and strategies<br>• Descriptions of using statistical thermodynamics<br>• Elastic theory of atoms<br>• Consequences of atomar properties on makroskopic Properties: Discussion of examples (metals, semiconductors, hybrid systems) |
| **Literature** | Für den **Elektromagnetismus:**<br>• Bergmann-Schäfer: „Lehrbuch der Experimentalphysik“, Band 2: „Elektromagnetismus“, de Gruyter<br>Für die **Atomphysik:**<br>• Haken, Wolf: „Atom- und Quantenphysik“, Springer<br>Für die **Materialphysik und Elastizität:**<br>• Hornbogen, Warlimont: „Metallkunde“, Springer |

## Module M0610: Electrical Machines and Actuators

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Electrical Machines and Actuators (L0293) | Lecture | 3 | 4 |
| Electrical Machines and Actuators (L0294) | Recitation Section (large) | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Thorsten Kern |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basics of mathematics, in particular complexe numbers, integrals, differentials<br><br>Basics of electrical engineering and mechanical engineering |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students can to draw and explain the basic principles of electric and magnetic fields.<br><br>They can describe the function of the standard types of electric machines and present the corresponding equations and characteristic curves. For typically used drives they can explain the major parameters of the energy efficiency of the whole system from the power grid to the driven engine. |
| *Skills* | Students are able to calculate two-dimensional electric and magnetic fields in particular ferromagnetic circuits with air gap. For this they apply the usual methods of the design auf electric machines.<br><br>They can calulate the operational performance of electric machines from their given characteristic data and selected quantities and characteristic curves. They apply the usual equivalent circuits and graphical methods. |
| **Personal Competence** | |
| *Social Competence* | none |
| *Autonomy* | Students are able independently to calculate electric and magnatic fields for applications. They are able to analyse independently the operational performance of electric machines from the charactersitic data and theycan calculate thereof selected quantities and characteristic curves. |
| **Workload in Hours** | Independent Study Time 110, Study Time in Lecture 70 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Subject theoretical and practical work |
| **Examination duration and scale** | Design of four machines and actuators, review of design files |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Elective Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Elective Compulsory<br>Digital Mechanical Engineering: Core Qualification: Compulsory<br>Electrical Engineering: Core Qualification: Elective Compulsory<br>Engineering Science: Specialisation Electrical Engineering: Elective Compulsory<br>Green Technologies: Energy, Water, Climate: Specialisation Energy Technology: Elective Compulsory<br>Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Mechanical Engineering: Core Qualification: Elective Compulsory<br>Mechatronics: Core Qualification: Compulsory<br>Technomathematics: Specialisation III. Engineering Science: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory |

| Course L0293: Electrical Machines and Actuators | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 3 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 78, Study Time in Lecture 42 |
| **Lecturer** | Prof. Thorsten Kern, Dennis Kähler |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Electric field: Coulomb´s law, flux (field) line, work, potential, capacitor, energy, force, capacitive actuators<br><br>Magnetic field: force, flux line, Ampere´s law, field at bounderies, flux, magnetic circuit, hysteresis, induction, self-induction, mutual inductance, transformer, electromagnetic actuators<br><br>Synchronous machines, construction and layout, equivalent single line diagrams, no-load and short-cuircuit characteristics, vector diagrams, motor and generator operation, stepper motors<br><br>DC-Machines: Construction and layout, torque generation mechanismen, torque vs speed characteristics, commutation,<br><br>Asynchronous Machines. Magnetic field, construction and layout, equivalent single line diagram, complex stator current diagram (Heylands´diagram), torque vs. speed characteristics, rotor layout (squirrel-cage vs. sliprings),<br><br>Drives with variable speed, inverter fed operation, special drives |
| **Literature** | Hermann Linse, Roland Fischer: "Elektrotechnik für Maschinenbauer", Vieweg-Verlag; Signatur der Bibliothek der TUHH: ETB 313<br><br>Ralf Kories, Heinz Schmitt-Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122<br><br>"Grundlagen der Elektrotechnik" - anderer Autoren<br><br>Fachbücher "Elektrische Maschinen" |

| Course L0294: Electrical Machines and Actuators | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Thorsten Kern, Dennis Kähler |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0865: Fundamentals of Production and Quality Management

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Production Process Organization (L0925) | Lecture | 2 | 3 |
| Quality Management (L0926) | Lecture | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Hermann Lödding |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | None |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to explain the contents of the lecture of the module. |
| *Skills* | Students are able to apply the methods and models in the module to industrial problems. |
| **Personal Competence** | |
| *Social Competence* | - |
| *Autonomy* | - |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 180 Minuten |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Advanced Materials: Elective Compulsory<br>Engineering Science: Core Qualification: Compulsory<br>Engineering Science: Specialisation Mechatronics: Elective Compulsory<br>Engineering Science: Specialisation Mechanical Engineering: Elective Compulsory<br>Engineering Science: Specialisation Advanced Materials: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Compulsory<br>Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory<br>Mechanical Engineering: Core Qualification: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Compulsory |

### Course L0925: Production Process Organization

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Hermann Lödding |
| **Language** | EN |
| **Cycle** | SoSe |
| **Content** | (A) Introduction<br>(B) Product planning<br>(C) Process planning<br>(D) Procurement<br>(E) Manufacturing<br>(F) Production planning and control (PPC)<br>(G) Distribution<br>(H) Cooperation |
| **Literature** | Wiendahl, H.-P.: Betriebsorganisation für Ingenieure<br>Vorlesungsskript |

| Course L0926: Quality Management | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Hermann Lödding |
| **Language** | EN |
| **Cycle** | SoSe |
| **Content** | • Definition and Relevance of Quality<br>• Continuous Quality Improvement<br>• Quality Management in Product Development<br>• Quality Management in Production Processes<br>• Design of Experiments |
| **Literature** | • Pfeifer, Tilo: Quality Management. Strategies, Methods, Techniques; Hanser-Verlag, München 2002<br>• Pfeifer, Tilo: Qualitätsmanagement. Strategien, Methoden, Techniken; Hanser-Verlag, München, 3. Aufl. 2001<br>• Mitra, Amitava: Fundamentals of Quality Control and Improvement; Wiley; Macmillan, 2008<br>• Kleppmann, W.: Taschenbuch Versuchsplanung. Produkte und Prozesse optimieren; Hanser-Verlag, München, 6. Aufl. 2009 |

## Module M0852: Graph Theory and Optimization

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Graph Theory and Optimization (L1046) | Lecture | 2 | 3 |
| Graph Theory and Optimization (L1047) | Recitation Section (small) | 2 | 3 |

| | |
|---|---|
| **Module Responsible** | Prof. Anusch Taraz |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | • Discrete Algebraic Structures<br>• Mathematics I |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • Students can name the basic concepts in Graph Theory and Optimization. They are able to explain them using appropriate examples.<br>• Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples.<br>• They know proof strategies and can reproduce them. |
| *Skills* | • Students can model problems in Graph Theory and Optimization with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods.<br>• Students are able to discover and verify further logical connections between the concepts studied in the course.<br>• For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. |
| **Personal Competence** | |
| *Social Competence* | • Students are able to work together in teams. They are capable to use mathematics as a common language.<br>• In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers. |
| *Autonomy* | • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them.<br>• Students have developed sufficient persistence to be able to work for longer periods in a goal-oriented manner on hard problems. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory<br>Computer Science: Core Qualification: Compulsory<br>Data Science: Core Qualification: Compulsory<br>Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Technomathematics: Specialisation I. Mathematics: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory |

| Course L1046: Graph Theory and Optimization | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Anusch Taraz |
| **Language** | DE/EN |
| **Cycle** | SoSe |
| **Content** | • Graphs, search algorithms for graphs, trees<br>• planar graphs<br>• shortest paths<br>• minimum spanning trees<br>• maximum flow and minimum cut<br>• theorems of Menger, König-Egervary, Hall<br>• NP-complete problems<br>• backtracking and heuristics<br>• linear programming<br>• duality<br>• integer linear programming |
| **Literature** | • M. Aigner: Diskrete Mathematik, Vieweg, 2004<br>• T. Cormen, Ch. Leiserson, R. Rivest, C. Stein: Algorithmen - Eine Einführung, Oldenbourg, 2013<br>• J. Matousek und J. Nesetril: Diskrete Mathematik, Springer, 2007<br>• A. Steger: Diskrete Strukturen (Band 1), Springer, 2001<br>• A. Taraz: Diskrete Mathematik, Birkhäuser, 2012<br>• V. Turau: Algorithmische Graphentheorie, Oldenbourg, 2009<br>• K.-H. Zimmermann: Diskrete Mathematik, BoD, 2006 |

| Course L1047: Graph Theory and Optimization | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 62, Study Time in Lecture 28 |
| **Lecturer** | Prof. Anusch Taraz |
| **Language** | DE/EN |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0553: Objectoriented Programming, Algorithms and Data Structures

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|

| | |
|---|---|
| **Module Responsible** | Prof. Rolf-Rainer Grigat |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | This lecture requires proficiency in the German language. For further requirements please refer to the German description. |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students can explain the essentials of software design and the design of a class architecture with reference to existing class libraries and design patterns.<br><br>Students can describe fundamental data structures of discrete mathematics and assess the complexity of important algorithms for sorting and searching. |
| *Skills* | Students are able to<br><br>• Design software using given design patterns and applying class hierarchies and polymorphism<br>• Carry out software development and tests using version management systems and Google Test<br>• Sort and search for data efficiently<br>• Assess the complexity of algorithms. |
| **Personal Competence** | |
| *Social Competence* | Students can work in teams and communicate in forums. |
| *Autonomy* | Students are able to solve programming tasks such as LZW data compression using SVN Repository and Google Test independently and over a period of two to three weeks. |
| **Workload in Hours** | Independent Study Time 180, Study Time in Lecture 0 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 60 Minutes, Content of Lecture, exercises and material in StudIP, last exam winter 2021/22 |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory |

## Module M0727: Stochastics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Stochastics (L0777) | Lecture | 2 | 4 |
| Stochastics (L0778) | Recitation Section (small) | 2 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Matthias Schulte |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | • Calculus<br>• Discrete algebraic structures (combinatorics)<br>• Propositional logic |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • Students can name the basic concepts in Stochastics. They are able to explain them using appropriate examples.<br>• Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples.<br>• They know proof strategies and can reproduce them. |
| *Skills* | • Students can model problems from stochastics with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods.<br>• Students are able to discover and verify further logical connections between the concepts studied in the course.<br>• For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. |
| **Personal Competence** | |
| *Social Competence* | • Students are able to work together (e.g. on their regular home work) in heterogeneously composed teams (i.e., teams from different study programs and background knowledge) and to present their results appropriately (e.g. during exercise class).<br>• In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers. |
| *Autonomy* | • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them.<br>• Students can put their knowledge in relation to the contents of other lectures.<br>• Students have developed sufficient persistence to be able to work for longer periods in a goal-oriented manner on hard problems. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory<br>General Engineering Science (German program, 7 semester): Specialisation Advanced Materials: Elective Compulsory<br>Computer Science: Core Qualification: Compulsory<br>Data Science: Core Qualification: Compulsory<br>Engineering Science: Specialisation Advanced Materials: Elective Compulsory<br>Engineering Science: Specialisation Electrical Engineering: Elective Compulsory<br>Computer Science in Engineering: Core Qualification: Compulsory<br>Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Orientation Studies: Core Qualification: Elective Compulsory<br>Theoretical Mechanical Engineering: Core Qualification: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory |

| Course L0777: Stochastics | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 92, Study Time in Lecture 28 |
| **Lecturer** | Prof. Matthias Schulte |
| **Language** | DE/EN |
| **Cycle** | SoSe |
| **Content** | • Definitions of probability, conditional probability<br>• Random variables<br>• Independence<br>• Distributions and density functions<br>• Characteristics: expectation, variance, standard deviation, moments<br>• Multivariate distributions<br>• Law of large numbers and central limit theorem<br>• Basic notions of stochastic processes<br>• Basic concepts of statistics (point estimators, confidence intervals, hypothesis testing) |
| **Literature** | • L. Dümbgen (2003): Stochastik für Informatiker, Springer.<br>• H.-O. Georgii (2012): Stochastics: Introduction to Probability and Statistics, 2nd edition, De Gruyter.<br>• N. Henze (2018): Stochastik für Einsteiger, 12th edition, Springer.<br>• A. Klenke (2014): Probability Theory: A Comprehensive Course, 2nd edition, Springer.<br>• U. Krengel (2005): Einführung in die Wahrscheinlichkeitstheorie und Statistik, 8th edition, Vieweg.<br>• A.N. Shiryaev (2012): Problems in probability, Springer. |

| Course L0778: Stochastics | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Matthias Schulte |
| **Language** | DE/EN |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Specialization Logistics and Mobility

Students gain Knowledge and skills in the important fields of logistics and mobility for their following professional carrier. First students learn the main basics in the field of logistics and mobility. Business related knowledge and methods for logistics and transport planning as well as specific knowledge of logistics technology and traffic engineering are tought. The project course and the individual choice of at least four electives enable students to specialize in selected field of logistics or mobility according to their interests.

### Module M1014: Logistics Service Provider Management

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Logistics Service Provider Management (L1240) | Seminar | 3 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Heike Flämig |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | • Introduction to Logistics and Mobility<br>• Transport and cross-docking Technology<br>• Logistics Management |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to...<br>• integrate LSPs into the concept of business logistics<br>• tell the specifics of business services and logistics Services and their derived characteristics<br>• describe logistics functions as LSP service packages<br>• explain, why companies outsource logistics Services and what are actual trends in Business<br>• describe basic outsorucing processes and tender management success factors<br>• describe and analyze intra- and intermodal transport institutions as well as tasks, challenges and opportunities for the Management of LSPs |
| *Skills* | Students can...<br>• support the sub-segment specific business functions and management Tasks (e.g. for Road Transport, Airlines, SeaPort Providers etc.)<br>• categorize LSPs regarding strategic product-market-positioning<br>• derive action plans regarding management tasks depending on contigencies |
| **Personal Competence** | |
| *Social Competence* | Students can...<br>• discuss case studies in Groups (within and outside of the classroom), reaching a common understanding and result<br>• prepare and deliver Business presentations<br>• give and discuss Feedbacks in the large group |
| *Autonomy* | Students can...<br>• produce written reports independently |
| **Workload in Hours** | Independent Study Time 138, Study Time in Lecture 42 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written elaboration |
| **Examination duration and scale** | 2 scientific written papers of approx. 20 pages each. Presentation (approx. 15 pages) with 20-minute closing lecture in groups of 3 to max. 5 persons. Grading of 4 partial grades of 25% each (2 seminar papers, 2 presentation documents) individually per group member. |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory |

| Course L1240: Logistics Service Provider Management | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 3 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 138, Study Time in Lecture 42 |
| **Lecturer** | Prof. Stephan Freichel |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | **1 Concept and Functions**<br><br>Define the role of logistics services providers in the overall concept and functions of logistics services providers. Workshop on the role of logistics services providers in the economy, based on up-to-date topics in the field and in the news.<br><br>**2 Outsourcing and Cooperation**<br><br>Make or buy, forms and management of inter-organizational relations<br><br>**3 Institutions**<br><br>Special business management features of carriers, haulage contractors, CEP services<br><br>**4 Trends, Strategies and Management Functions**<br><br>Market trends, requirements, basic business management and management functions (operations, business development, HR, IT, finance/planning and control, organization, leadership)<br><br>**5 Strategic Developments and Case Studies**<br><br>Selected aspects (e.g. risk and innovation management, global and regional networking, greenwashing and sustainability)<br><br>Examples:<br><br>Case Study A) Types of company (such as haulage contractors, railway operators, road transport companies, heavy goods, textile and refrigerated goods specialists, CEPs, etc) will be introduced and discussed in the context of a presentation.<br><br>Case Study B) Individual companies will be analyzed on the basis of accessible material such as company reports, websites and possibly telephone interviews and case studies will be explained and discussed with regard to the functions of the logistics services provider and the management task of the corporate managements of the selected cases. |
| **Literature** | Pfohl, H.-Chr.: Logistiksysteme. Betriebswirtschaftliche Grundlagen.<br>8., neu bearbeite und aktualisierte Auflage, Berlin u.a. 2009<br><br>Eßig, M. / Hofmann, E. / Stölzle, W.: Supply Chain Management. München 2013.<br><br>Freichel, S.L.K.: Organisation von Logistikservice-Netzwerken. Reihe: Logistik und Unternehmensführung, hrsg. von Prof. Dr. H.-Chr. Pfohl, Bd. 4. Berlin 1993.<br><br>Aberle, G.: Transportwirtschaft. Einzelwirtschaftliche und gesamtwirtschaftliche Grundlagen, 4. überarbeitete und erweiterte Auflage, München/Wien 2006.<br><br>Buchholz, J./Clausen, U./Vastag, A. (Hrsg): Handbuch der Verkehrslogistik, Heidelberg 1998.<br><br>Corsten, H.: Dienstleistungsmanagement, 3. Auflage, München 1997.<br><br>Müller-Daupert, B. (Hrsg.): Logistik-Outsourcing, 2. Auflage, München, Vogel, 2009<br><br>Ihde, G. B.: Transport, Verkehr, Logistik. Gesamtwirtschaftliche Aspekte und einzelwirtschaftliche Handhabung, 3. völlig überarb. und erw. Auflage, München 2001.<br><br>van Suntum, U.: Verkehrspolitik, München 1986. |

## Module M0983: Mobility Concepts

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Mobility Research and Transportation Projects (L1181) | Project-/problem-based Learning | 3 | 3 |
| Mobility in Megacities and Developing Countries (L1182) | Seminar | 3 | 3 |

**Module Responsible**: Dr. Philine Gaffron

**Admission Requirements**: None

**Recommended Previous Knowledge**: Module Transportation Planning and Traffic Engineering

**Educational Objectives**: After taking part successfully, students have reached the following learning results

**Professional Competence**

*Knowledge*

Students are able to:

- name the different urban transport systems existing around the world.
- explain the transport challenges in Asian and African mega cities.
- recognise and relate interactions between transport systems on the one hand and ecological, socio-cultural and economic problem areas on the other.
- outline specific issues and problems in urban development and transport (in Germany and developing countries).
- explain the effects of external framework factors (like energy costs) on transport.

*Skills*

Students are able to:

- analyse and evaluate given case studies.
- transfer learning results to other regions and cities.
- analyse specific issues and problems in urban development and transport (in developing countries).
- critically assess actors, planning objectives, planned measures and the implementation of transport projects in the light of the UN Millennium Development Goals
- develop and present sustainable (i.e. ecological, poverty oriented, gender balanced and economical) solutions for urban personal and goods transport

**Personal Competence**

*Social Competence*

Students are able to:

- present and explain independently generated findings.
- constructively discuss potentially controversial topics in a group context.

*Autonomy*

Students are able to:

- carry out independent literature research and analysis.
- independently author a written report on a given topic.

**Workload in Hours**: Independent Study Time 96, Study Time in Lecture 84

**Credit points**: 6

**Course achievement**

| Compulsory | Bonus | Form | Description |
|---|---|---|---|
| Yes | None | Participation in excursions | |
| Yes | None | Excercises | |

**Examination**: Written elaboration

**Examination duration and scale**: All assignments in groups (2-4 students): written report, 2000 words (incl. 2 short presentations of 10 mins.); final presentation, 20 mins. plus discussion (incl. slides) and 1000 word report incl. peer review (individual).

**Assignment for the Following Curricula**

Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory
Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory
Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory
Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory
Logistics and Mobility: Specialisation Traffic Planning and Systems: Compulsory
Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Compulsory

| Course L1181: Mobility Research and Transportation Projects | |
|---|---|
| **Typ** | Project-/problem-based Learning |
| **Hrs/wk** | 3 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 48, Study Time in Lecture 42 |
| **Lecturer** | Dr. Philine Gaffron |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | This course places its focus on transport and mobility in Germany. It deals with questions such as:<br>• Which external factors - like e.g. energy costs, availability of renewable and fossil fuels, environmental and climate protection objectives - influence current developments in the transport sector?<br>• Which external effects in turn are caused by mobility choices and traffic?<br>• How should these interactions be evaluated, how and by whom can they be influenced?<br>• Which measures at the municipal level can contribute to a more sustainable transport system?<br>During the course, these questions will be illustrated and discussed with reference to different examples and current developments. Participants will also provide input on specific topics. Potential core subjects of the course could be:<br>• Environmental Justice : which population groups are disproportionately affected by transport emissions and who causes them?<br>• Municipal cycle planning<br>• Transport and Climate Protection: can, want, act - everything could be, nothing must be? |
| **Literature** | Die Literaturempfehlungen sind abhängig von den jeweiligen, wechselnden Themenschwerpunkten und werden rechtzeitig vor Beginn der Veranstaltung bekannt gegeben. |

| Course L1182: Mobility in Megacities and Developing Countries | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 3 |
| **CP** | 3 |
| **Workload in Hours** | Independent Study Time 48, Study Time in Lecture 42 |
| **Lecturer** | Dr. Jürgen Perschon, Christof Hertel |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | The course provides and overview over different transport projects in the metropolitan areas of developing countries. Considering different perspectives on urban growth, social justice, economic development, environmental and climate protection as well as the economic viability of public transport, the specific situation in the urban conglomerates of Asia, Latin America and Africa will be analysed and placed in a regional and global context. Specific public transport systems will be examined to establish, whether they are a suitable example for sustainable urban development.<br>The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guanghzou, Bogota, Jakarta (Full BRT), Sao Paulo, Medellin (Cable Car Systems), Johannesburg (Minibus-Taxi).<br>The course will be designed interactively with the students and will partly be in English as is the majority of the literature in this area (also: Skype online interviews with international experts in the transport sector). |
| **Literature** | -- |

## Module M1290: Simulation of intra logistics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Simulation of intra logistics (L1755) | Seminar | 4 | 6 |

| | |
|---|---|
| **Module Responsible** | Dr. Johannes Hinckeldeyn |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Successful completion of the module „Technical Logistics“ |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students will acquire the following knowledge:<br>1. The students are able to explain the significance, the structure and the components of an event- and object-oriented simulation model in intralogistics.<br>2. The students are able to reflect and explain the process of creating and programming an event- and object-oriented simulation model in intralogistics.<br>3. The students are able to view critically the strengths and weaknesses of event- and object-oriented simulation model. |
| *Skills* | The students will acquire the following skills:<br>1. The students will be able to derive the necessary parameters for the development of an event- and object-oriented simulation model in intralogistics from an existing logistics system.<br>2. The students will be able to program and run Plant Simulation simulation models independently.<br>3. The students can evaluate and interpret the results from a simulation model. |
| **Personal Competence** | |
| *Social Competence* | The students will acquire the following social skills:<br>1. The students are able to develop a complex simulation model in a team.<br>2. The students know the different roles in joint development of a simulation model and can give feedback to their respective roles.<br>3. The students are able to process the simulation results and present them in front of a audience. |
| *Autonomy* | The students will acquire the following independent competencies:<br>1. The students work independently in an initially unknown software (Plant Simulation).<br>2. The students are able to derive independently the necessary simulation parameters from information about a logistics system.<br>3. The students are able to develop and program an event- and object-oriented simulation models from given parameters. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 120 min |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory |

| Course L1755: Simulation of intra logistics | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 4 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Lecturer** | Dr. Johannes Hinckeldeyn |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | The seminar provides an introduction to the development and programming of event and object-oriented simulation models based on the Plant Simulation software. The simulation models are focused on issues and problems in the field of intralogistics.<br>The seminar will be conducted as a combination of theoretical content and autonomously solving simulation tasks on the computer.<br><br>The students learn the ideal development workflow, programming and evaluation of a simulation model.<br><br>Furthermore, the student will become familiar with the standard objects of a simulation model in Plant Simulation and their properties and functions. These standard objects will be used, if necessary with the assistance of the instructor, to build simulation models and analyze and evaluate the results.<br><br>Furthermore, an introduction to the individual programming of simulation models is given on the basis of Sim Talk language. |
| **Literature** | Bangsow, Steffen (2011): Praxishandbuch Plant Simulation und SimTalk, Hanser Verlag, München.<br>Bangsow, Steffen (2015): Tecnomatix plant simulation : modeling and programming by means of examples, Springer, Berlin.<br><br>Eley, Michael (2012): Simulation in der Logistik : Einführung in die Erstellung ereignisdiskreter Modelle unter Verwendung des Werkzeuges "Plant Simulation", Springer, Berlin. |

## Module M1112: Production Logistics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Production Logistics Seminar (L1253) | Seminar | 2 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Thorsten Blecker |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Knowledge: Students will have acquired knowledge in the following areas:<br>• interaction of production and logistics and interdependencies<br>• production-related logistics topics |
| *Skills* | Skills: Students will based on the acquired knowledge be in a position to<br>• assess issues on production logistics<br>• to be able to deal critically with developments in production logistics and assess these critically;<br>• to work independently on current topics from the field of "production logistics"; |
| **Personal Competence** | |
| *Social Competence* | Social competence: After completing the module students are capable of<br>• to conduct subject-specific and interdisciplinary discussions;<br>• present orally and in writing their results;<br>• respectful team work |
| *Autonomy* | After completing the module students are capable to work independently on a subject and transfer the acquired knowledge to new problems. |
| **Workload in Hours** | Independent Study Time 152, Study Time in Lecture 28 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written elaboration |
| **Examination duration and scale** | approx. 20 pages plus presentation (20 minutes per person) |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory |

### Course L1253: Production Logistics Seminar

| | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 2 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 152, Study Time in Lecture 28 |
| **Lecturer** | Prof. Thorsten Blecker |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | Within the Production Logistics Seminar the students shall compose a first term paper. In the beginning production-close logstic topics will be distributed which the students have to elaborate on their own. This workshop aims at the better motivation of the students to structure new and creative ideas and develop them to innovative solutions. This workshop contains regular meetings as well as two presentations in the middle and at the end. |
| **Literature** | Skripte und Textdokumente, die während der Vorlesung herausgegeben werden. |

## Module M1289: Logistical systems - Industry 4.0

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Logistics systems - Industry 4.0 (L1753) | Seminar | 4 | 6 |

| | |
|---|---|
| **Module Responsible** | Prof. Jochen Kreutzfeldt |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Successful completion of the module „Technical Logistics“ |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students will acquire the following knowledge:<br>1. The students are able to understand and explain the concept "Logistical System".<br>2. The students are able to design a logistic system conceptually.<br>3. The students can develop and implement the control of a logistic system with python. |
| *Skills* | The students will acquire the following skills:<br>1. The students are able to identify logistical systems, analyze and identify potential for change and improvement.<br>2. The students know different technical solutions to address problems in logistical systems.<br>3. The students are capable of deploying technical solutions and ideas from the concept Industry 4.0 to deal with logistical problems. |
| **Personal Competence** | |
| *Social Competence* | The students will acquire the following social skills:<br>1. The students are able to develop technical solutions for logistical systems and reflect their contribution within the team.<br>2. The technical solutions from the group can be jointly documented and presented.<br>3. Students are able to present their technological solutions to an audience and derived from the critique new ideas and improvements. |
| *Autonomy* | The students will acquire the following independent competencies:<br>1. The students can independently develop technical solutions for logistical problems under supervision.<br>2. The students are able to evaluate their technical solutions and discuss the pros and cons.<br>3. The students are able to assess the impact of the concept Industry 4.0 on their own career development. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written elaboration |
| **Examination duration and scale** | Lab prototype with documentation (group work) |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory |

| Course L1753: Logistics systems - Industry 4.0 | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 4 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Lecturer** | Prof. Jochen Kreutzfeldt, Dr. Johannes Hinckeldeyn |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The lecture gives an introduction to the concept of logistical systems with a special emphasis on the subject of Industry 4.0. Here, the system concept in logistics from a technical point of view is introduced. A logistical system is understood as a combination of transport, storage and change processes between source and sink of goods. This lecture will look at the technical aspect of these processes.<br>Industry is a topic of this lecture. Industry 4.0 is understood as the far-reaching digitization and networking of logistical systems and the connection of logistical objects, processes and systems. The logistics industry expects Industry 4.0 to be a profound change and the realization of large improvement potentials. The lecture provides an in-depth introduction to application cases and business models of Industry 4.0 in logistics from a technical standpoint. A possible framework for Industry 4.0 is presented and several application examples are shown.<br><br>In the exercises, students learn will learn the exemplary use of different technical solutions and know how, which can be used to improve logistical systems. |
| **Literature** | Bauernhansl, Thomas et al. (2014): Industrie 4.0 in Produktion, Automatisierung und Logistik. Anwendung, Technologien, Migration. Wiesbaden: Springer Vieweg.<br>Hausladen, Iris (2014): IT-gestützte Logistik. Systeme - Prozesse - Anwendungen. 2. Auflage 2014. Wiesbaden: Imprint: Gabler Verlag.<br><br>Hompel, Michael ten; Büchter, Hubert; Franzke, Ulrich (2008): Identifikationssysteme und Automatisierung. [Intralogistik]. Berlin, Heidelberg: Springer.<br><br>Kaufmann, Timothy (2015): Geschäftsmodelle in Industrie 4.0 und dem Internet der Dinge. Der Weg vom Anspruch in die Wirklichkeit. Wiesbaden: Springer Fachmedien Wiesbaden.<br><br>Martin, Heinrich (2014): Transport- und Lagerlogistik. Planung, Struktur, Steuerung und Kosten von Systemen der Intralogistik. 9., Auflage 2014. Wiesbaden: Imprint: Springer Vieweg.<br><br>Runkler, Thomas A. (2010): Data-Mining. Methoden und Algorithmen intelligenter Datenanalyse. 1. Aufl. Wiesbaden: Vieweg + Teubner (Studium). |

## Module M1349: Object-oriented programming in logistics

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Object-oriented programming in logistics (L1901) | Seminar | 4 | 6 |

| | |
|---|---|
| **Module Responsible** | Dr. Johannes Hinckeldeyn |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basic computer skills<br><br>Computer Science for Engineers - Introduction and Overview |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | The students will acquire the following knowledge:<br><br>1. The students are able to explain the basics of object-oriented programming with Java.<br><br>2. The students know basic data types, control structures and basic concepts of object orientation and inheritance in the Java programming language.<br><br>3. The students know the necessary tools for programming with Java. |
| *Skills* | The students will acquire the following skills:<br><br>1. The students will be able to develop and run programs with Java independently.<br><br>2. The students will be able to develop and implement own objects and classes with Java.<br><br>3. The students are able to identify and overcome failures autonomously (debugging). |
| **Personal Competence** | |
| *Social Competence* | The students will acquire the following social skills:<br><br>1. The students can explain self-developed programs to other students.<br><br>2. The students can support others in finding failures and mistakes in their software-code.<br><br>3. The students are able to present their programs in front of a audience. |
| *Autonomy* | The students will acquire the following competencies:<br><br>1. The students work independently with an initially unknown programming language (Java).<br><br>2. The students are able to derive independently the necessary source code for a given problem.<br><br>3. The students are able to write their own source code in Java based on given a problem. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 90 min |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory |

| Course L1901: Object-oriented programming in logistics | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 4 |
| **CP** | 6 |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Lecturer** | Dr. Johannes Hinckeldeyn |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The seminar provides an introduction to object-oriented programming with Java. Practical knowledge will be transferred through programming exercises parallel to theoretical content. The exercises will deal mainly with logistical problems.<br><br>The seminar will be conducted as an integrated seminar with a combination of theoretical content and autonomously solved programming problems on the computer.<br><br>Furthermore, the student will become familiar with the standard libraries of Java and their properties and functions. These standard objects will be used, if necessary with the assistance of an instructor, to build own programs.<br><br>Furthermore, an introduction to the actual software development kits (SDK) of Java will be given. |
| **Literature** | Goll, Joachim; Heinisch, Cornelia (2014): Java als erste Programmiersprache. Ein professioneller Einstieg in die Objektorientierung mit Java. 7. Aufl. 2014. Wiesbaden: Imprint: Springer Vieweg.<br><br>Jobst, Fritz (2015): Programmieren in Java. [aktuell zu Java 8]. 7., vollst. überarb. Aufl. München: Hanser.<br><br>Abts, Dietmar (2015): Grundkurs JAVA. Von den Grundlagen bis zu Datenbank- und Netzanwendungen. 8. Aufl. Wiesbaden: Springer Vieweg. |

## Module M1070: Simulation of Transport and Handling Systems

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Simulation of Transport and Handling Systems (L1352) | Lecture | 1 | 2 |
| Simulation of Transport and Handling Systems (L1818) | Recitation Section (small) | 3 | 4 |

| | |
|---|---|
| **Module Responsible** | Prof. Carlos Jahn |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basic knowledge of transport- and handlingtechnology. |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students can...<br>• Explain the structure and workings of standard external logistics systems.<br>• Outline the benefits of using simulation software subject to the starting situation.<br>• Present different simulation programs and kinds of simulation that are in widespread use and explain their characteristics. |
| *Skills* | Students are able to...<br>• Recognize, analyze, and assemble into a model the elementary building blocks of a logistics system.<br>• Map complex external logistics process using the *Plant Simulation*® simulation software.<br>• Draw inferences from the results of the simulation, transfer them to the reality, and deduce action recommendations from them. |
| **Personal Competence** | |
| *Social Competence* | Students are capable of...<br>• Solving complex tasks in a team and to document assignments accordingly.<br>• Playing different roles in the teamwork and giving each other appropriate feedback in the team.<br>• Presenting the relevant results of their project to specialists and representing them. |
| *Autonomy* | Students are able...<br>• To acquaint themselves independently with software with which they are not familiar and to use it to solve complex tasks.<br>• To define work steps independently and to acquire the knowledge required to do so. |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | **Compulsory** / **Bonus** / **Form** / **Description**<br>No / 20 % / Subject theoretical and practical work |
| **Examination** | Subject theoretical and practical work |
| **Examination duration and scale** | Simulation study and report with approximately 15 pages per person |
| **Assignment for the Following Curricula** | Data Science: Core Qualification: Elective Compulsory<br>Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory |

| Course L1352: Simulation of Transport and Handling Systems | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 1 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 46, Study Time in Lecture 14 |
| **Lecturer** | Prof. Carlos Jahn |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | The lecture deals with the simulation of external logistics systems. The focus is therefore on the consideration of logistical processes between companies or on transhipment systems, such as ports or individual terminals.<br><br>In the first part of the lecture, students will first acquire basic knowledge of external logistics systems and the advantages of using simulations to present them. Then an overview of existing simulation types and programs is given and examples for existing simulation models of logistic systems in science and practice are shown. Some simulation models will be demonstrated.<br><br>In the second part of the lecture the students learn the basic handling of the simulation software Plant Simulation®. They receive theoretical explanations of the general functionality of the simulation tool, which are further deepened through the use of extensive, interactive examples. At the same time, five exercises, which build on each other, offer students the opportunity to implement the course content they have learnt in small groups. The exercises can be completed during the supervised lecture periods as well as at other times.<br><br>The acquired knowledge is to be applied in the third part in the course of group work. The students will be divided into groups, each of which will then work on a relevant problem from the field of (external) logistic systems by means of simulation. The students are given a defined period of time for their work. During this time at least one person is always available for questions and suggestions. The results of the group work are to be documented in a simulation report and handed in at the end of the processing time. Finally, the individual groups present the problems they have worked on and their results in a presentation. |
| **Literature** | Bangsow, Steffen (2011): Praxishandbuch Plant Simulation und SimTalk. Anwendung und Programmierung in über 150 Beispiel-Modellen. München: Hanser Verlag.<br><br>Eley, Michael (2012): Simulation in der Logistik. Einführung in die Erstellung ereignisdiskreter Modelle unter Verwendung des Werkzeuges "Plant Simulation". Berlin, Heidelberg: Springer.<br><br>Engelhardt-Nowitzki, Corinna; Nowitzki, Olaf; Krenn, Barbara (2008): Management komplexer Materialflüsse mittels Simulation. State-of-the-Art und innovative Konzepte. Wiesbaden: Deutscher Universitäts-Verlag / GWV Fachverlage GmbH, Wiesbaden.<br><br>Rabe, Markus; Spieckermann, Sven; Wenzel, Sigrid (2008): Verifikation und Validierung für die Simulation in Produktion und Logistik. Vorgehensmodelle und Techniken. Berlin, Heidelberg: Springer.<br><br>Sargent, Robert G. (2010): Verification and Validation of Simulation Models. In: B. Johansson, S. Jain, J. Montoya-Torres, J. Hugan, and E. Yücesan, eds.: Proceedings of the 2010 Winter Simulation Conference.<br><br>VDI-Richlinie: VDI 3633. Simulation von Logistik-, Materialfluß-und Produktionssystemen<br><br>Wenzel, Sigrid; Rabe, Markus; Spieckermann, Sven (2006): Verifikation und Validierung für die Simulation in Produktion und Logistik. Vorgehensmodelle und Techniken. 1. Aufl. Berlin: Springer Berlin. |

| Course L1818: Simulation of Transport and Handling Systems | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 3 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 78, Study Time in Lecture 42 |
| **Lecturer** | Prof. Carlos Jahn |
| **Language** | DE |
| **Cycle** | WiSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0985: Introduction to Railways

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Introduction to Railways (L1184) | Lecture | 2 | 4 |
| Introduction to Railways (L1185) | Recitation Section (large) | 1 | 2 |

| | |
|---|---|
| **Module Responsible** | Prof. Carsten Gertz |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | none |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students can...<br>• give definitions for basic terms related to railways<br>• explain specifics concerning the handling of goods on railways<br>• explain the required infrastructure<br>• describe the work at the track super structure |
| *Skills* | -- |
| **Personal Competence** | |
| *Social Competence* | Students can...<br>• work at tasks in groups and come to results together<br>• discuss contents in groups, summarize them and present them in front of others<br>• convey contents to other by processing them in writing |
| *Autonomy* | Students can work out and understand contents themselves during the lecture through literature research |
| **Workload in Hours** | Independent Study Time 138, Study Time in Lecture 42 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 90 min |
| **Assignment for the Following Curricula** | Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory<br>Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory<br>Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory<br>Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory |

### Course L1184: Introduction to Railways

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 92, Study Time in Lecture 28 |
| **Lecturer** | Ralf Peix |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Lecture:<br>The module provides a basic knowledge of the field of railroad engineering. An overview of railroad operations, control and safety technology, railroad superstructure, structural engineering, project management as well as maintenance and design of infrastructure facilities is given. The aim of this module is to give students as much insight as possible into railroad infrastructure. The module is examined by means of a written exam at the end of the semester.<br>Lecture Hall Exercise:<br>In order to give the students practical examples, full-day practical excursions are carried out. New handling techniques and currently available hardware will be presented by visiting the marshalling yard "die Zugbildungsanlage Maschen (ZBA)". Furthermore, the training center for track construction and civil engineering as well as the operations center in Hanover will be visited, where facilities and tasks will be presented. Questionnaires will also be provided for practice purposes. In addition, study papers can be handed out and supervised as required. |
| **Literature** | Die maßgebliche Literatur wird in StudIP veröffentlicht. Weitere Hinweise werden in der Veranstaltung gegeben. |

| Course L1185: Introduction to Railways | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 46, Study Time in Lecture 14 |
| **Lecturer** | Ralf Peix |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

## Module M0980: Logistics, Transport and Environment

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Environmental Management and Corporate Responsibilty (L1160) | Seminar | 2 | 2 |
| Transport Logistics (L0009) | Project-/problem-based Learning | 2 | 4 |

| | |
|---|---|
| **Module Responsible** | Prof. Heike Flämig |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | • Introduction to logistics and mobility<br>• Foundations of Management |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students are able to...<br>• explain basic terms of transport logistics, commercial traffic, transport policy and sustainability<br>• describe actors and system boundaries, challenges and goals of transport logistics<br>• reflect standards of sustainability management |
| *Skills* | Students are able to...<br>• design logistics systems independently<br>• differentiate sustainability, CR, CSR and environmental management<br>• critically evaluate measures for sustainable logistics and develop them |
| **Personal Competence** | |
| *Social Competence* | Students can...<br>• creatively develop solutions in teams and work out presentations<br>• present their knowledge and skills to other students |
| *Autonomy* | Students can...<br>• carry out small research studies independently<br>• apply theoretical knowledge in practical projects<br>• apply presentation techniques such as free speech, designing charts (i.e. in Power-Point), use of media (Flip-Charts, Whiteboard, Metaplan) |
| **Workload in Hours** | Independent Study Time 124, Study Time in Lecture 56 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written elaboration |
| **Examination duration and scale** | Written assignment with short presentation |
| **Assignment for the Following Curricula** | Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Logistics and Mobility: Specialisation Information Technology: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Production Management and Processes: Elective Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Information Technology: Elective Compulsory |

### Course L1160: Environmental Management and Corporate Responsibilty

| | |
|---|---|
| **Typ** | Seminar |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Heike Flämig |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | • Imparting knowledge about standards (e.g. EMAS and ISO 14.001) as important methodological approaches for the integration of environmental and sustainability management in business companies<br>• Explaination of theoretical concepts of corporate sustainability management<br>• Imparting pracitical knowledge from different stakeholder views: consulting company, trading enterprise, NGO, financial market |
| **Literature** | -- |

| Course L0009: Transport Logistics | |
|---|---|
| **Typ** | Project-/problem-based Learning |
| **Hrs/wk** | 2 |
| **CP** | 4 |
| **Workload in Hours** | Independent Study Time 92, Study Time in Lecture 28 |
| **Lecturer** | Prof. Heike Flämig |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | Application and creative development of professional knowledge within the framework of the case study "Environmental impacts of supply chains" using a specific company as example.<br><br>Depending on the chosen focus of the academic year:<br><br>• characteristics of different transport systems<br>• technologies, structures and processes of transport logistics systems (nodes, network, interactions)<br>• location and route planning<br>• connections of information flow and material flows in transport chains<br>• interrelation between private and private (contract logistics) and private and public (business policy, transport policy) and their (diverging)<br>• design approaches for sustainable logistics |
| **Literature** | Ihde, Gösta B.: Transport, Verkehr, Logistik. Gesamtwirtschaftliche Aspekte und einzelwirtschaftliche Handhabung. 3. überarbeitete Auflage. Vahlen, München 2001 |

## Module M0767: Aeronautical Systems

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|
| Fundamentals of Aircraft Systems (L0741) | Lecture | 2 | 2 |
| Fundamentals of Aircraft Systems (L0742) | Recitation Section (small) | 1 | 1 |
| Air Transportation Systems (L0591) | Lecture | 2 | 2 |
| Air Transportation Systems (L0816) | Recitation Section (large) | 1 | 1 |

| | |
|---|---|
| **Module Responsible** | Prof. Frank Thielecke |
| **Admission Requirements** | None |
| **Recommended Previous Knowledge** | Basics of mathematics, mechanics and thermodynamics |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | Students get a basic understanding of the structure and design of an aircraft, as well as an overview of the systems inside an aircraft. In addition, a basic knowledge of the relationchips, the key parameters, roles and ways of working in different subsystems in the air transport is acquired. |
| *Skills* | Due to the learned cross-system thinking students can gain a deeper understanding of different system concepts and their technical system implementation. In addition, they can apply the learned methods for the design and assessment of subsystems of the air transportation system in the context of the overall system. |
| **Personal Competence** | |
| *Social Competence* | Students are made aware of interdisciplinary communication in groups. |
| *Autonomy* | Students are able to independently analyze different system concepts and their technical implementation as well as to think system oriented. |
| **Workload in Hours** | Independent Study Time 96, Study Time in Lecture 84 |
| **Credit points** | 6 |
| **Course achievement** | None |
| **Examination** | Written exam |
| **Examination duration and scale** | 150 min |
| **Assignment for the Following Curricula** | General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory<br>Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory<br>Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory<br>Mechanical Engineering: Specialisation Aircraft Systems Engineering: Compulsory<br>Engineering and Management - Major in Logistics and Mobility: Specialisation Traffic Planning and Systems: Elective Compulsory |

### Course L0741: Fundamentals of Aircraft Systems

| | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Frank Thielecke |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | - Development of aircrafts, fundamentals of flight physics, propulsion systems, analysis of ranges and loads, aircraft-structures and materials<br>- Hydraulic and electrical power systems, landing gear systems, flight-control and high-lift systems, air conditioning systems |
| **Literature** | - Shevell, R. S.: Fundamentals of Flight<br>- TÜV Rheinland: Luftfahrtzeugtechnik in Theorie und Praxis<br>- Wild: Transport Category Aircraft Systems |

### Course L0742: Fundamentals of Aircraft Systems

| | |
|---|---|
| **Typ** | Recitation Section (small) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Frank Thielecke |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

| Course L0591: Air Transportation Systems | |
|---|---|
| **Typ** | Lecture |
| **Hrs/wk** | 2 |
| **CP** | 2 |
| **Workload in Hours** | Independent Study Time 32, Study Time in Lecture 28 |
| **Lecturer** | Prof. Volker Gollnick |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | 1. Air transport as part of the global transportation system<br>2. Legal basis of air transportation<br>3. Safety and security aspects<br>4. Aircraft basics<br>5. The role of the aircraft amnufacturer<br>6. The role of the aircraft operator<br>7. Airport operation<br>8. The principles of air traffic management<br>9. Environmental aspects of air transportation |
| **Literature** | 1. V. Gollnick, D. Schmitt: "Air Transport System", Springer-Verlag, ISBN 978-3-7091-1879-5<br>2. H. Mensen: "Handbuch der Luftfahrt", Springer-Verlag, 2003<br>3. J.P. Clark: “Buying the Big Jets”, ISBN 9781317170341 , Taylor & Francis, 2017<br>4. Mike Hirst: The Air Transport System, AIAA, 2008<br>5. D.P. Raymer: "Aircraft Design - A Conceptual Approach", AIAA Education Series, 2006, ISBN 1-56347-281-3<br>6. N. Ashford: "Airport Operations", McGraw-Hill, 1997, ISBN 0-07-003077-4<br>7. P. Maurer: "Luftverkehrsmanagement", Oldenbourg-Verlag, ISBN 3-486-27422-8<br>8. H. Mensen: "Moderne Flugsicherung", Springer-Verlag, 2004, ISBN 3-540-20581-0 |

| Course L0816: Air Transportation Systems | |
|---|---|
| **Typ** | Recitation Section (large) |
| **Hrs/wk** | 1 |
| **CP** | 1 |
| **Workload in Hours** | Independent Study Time 16, Study Time in Lecture 14 |
| **Lecturer** | Prof. Volker Gollnick |
| **Language** | DE |
| **Cycle** | SoSe |
| **Content** | See interlocking course |
| **Literature** | See interlocking course |

# Thesis

## Module M-001: Bachelor Thesis

**Courses**

| Title | Typ | Hrs/wk | CP |
|---|---|---|---|

| | |
|---|---|
| **Module Responsible** | Professoren der TUHH |
| **Admission Requirements** | • According to General Regulations §21 (1):<br>At least 126 ECTS credit points have to be achieved in study programme. The examinations board decides on exceptions. |
| **Recommended Previous Knowledge** | |
| **Educational Objectives** | After taking part successfully, students have reached the following learning results |
| **Professional Competence** | |
| *Knowledge* | • The students can select, outline and, if need be, critically discuss the most important scientific fundamentals of their course of study (facts, theories, and methods).<br>• On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of opening up and establishing links with extended specialized expertise.<br>• The students are able to outline the state of research on a selected issue in their subject area. |
| *Skills* | • The students can make targeted use of the basic knowledge of their subject that they have acquired in their studies to solve subject-related problems.<br>• With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technical issues, and develop solutions.<br>• The students can take up a critical position on the findings of their own research work from a specialized perspective. |
| **Personal Competence** | |
| *Social Competence* | • Both in writing and orally the students can outline a scientific issue for an expert audience accurately, understandably and in a structured way.<br>• The students can deal with issues in an expert discussion and answer them in a manner that is appropriate to the addressees. In doing so they can uphold their own assessments and viewpoints convincingly. |
| *Autonomy* | • The students are capable of structuring an extensive work process in terms of time and of dealing with an issue within a specified time frame.<br>• The students are able to identify, open up, and connect knowledge and material necessary for working on a scientific problem.<br>• The students can apply the essential techniques of scientific work to research of their own. |
| **Workload in Hours** | Independent Study Time 360, Study Time in Lecture 0 |
| **Credit points** | 12 |
| **Course achievement** | None |
| **Examination** | Thesis |
| **Examination duration and scale** | According to General Regulations |
| **Assignment for the Following Curricula** | General Engineering Science (German program): Thesis: Compulsory<br>General Engineering Science (German program, 7 semester): Thesis: Compulsory<br>Civil- and Environmental Engineering: Thesis: Compulsory<br>Bioprocess Engineering: Thesis: Compulsory<br>Chemical and Bioprocess Engineering: Thesis: Compulsory<br>Computer Science: Thesis: Compulsory<br>Data Science: Thesis: Compulsory<br>Digital Mechanical Engineering: Thesis: Compulsory<br>Electrical Engineering: Thesis: Compulsory<br>Energy and Environmental Engineering: Thesis: Compulsory<br>Engineering Science: Thesis: Compulsory<br>General Engineering Science (English program): Thesis: Compulsory<br>General Engineering Science (English program, 7 semester): Thesis: Compulsory<br>Green Technologies: Energy, Water, Climate: Thesis: Compulsory<br>Computer Science in Engineering: Thesis: Compulsory<br>Integrated Building Technology: Thesis: Compulsory<br>Logistics and Mobility: Thesis: Compulsory<br>Mechanical Engineering: Thesis: Compulsory<br>Mechatronics: Thesis: Compulsory<br>Naval Architecture: Thesis: Compulsory<br>Technomathematics: Thesis: Compulsory<br>Teilstudiengang Lehramt Elektrotechnik-Informationstechnik: Thesis: Compulsory<br>Teilstudiengang Lehramt Metalltechnik: Thesis: Compulsory<br>Process Engineering: Thesis: Compulsory |

| | |
|---|---|
| | Engineering and Management - Major in Logistics and Mobility: Thesis: Compulsory |