Ostfalia
Hochschule für angewandte Wissenschaften

Status: 30.06.2024

Module catalog

Bachelor's degree program (B.Sc.)
Smart Transportation Systems (STS)

Ostfalia University of Applied Sciences - Braunschweig/Wolfenbüttel University of Applied Sciences
Karl-Scharfenberg-Str. 55-57 - 38229 Salzgitter
www.ostfalia.de

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Explanations of the module catalog

The possibility of admission to the degree program "Smart Transportation System - Intelligent Transport Systems (STS)" in both the winter and summer semesters changes the semester situation.
For students who are admitted in the winter semester, the following sequence of module blocks is planned: 1, 2, 3, 4, 5, 6, 7 (see Figure 1)

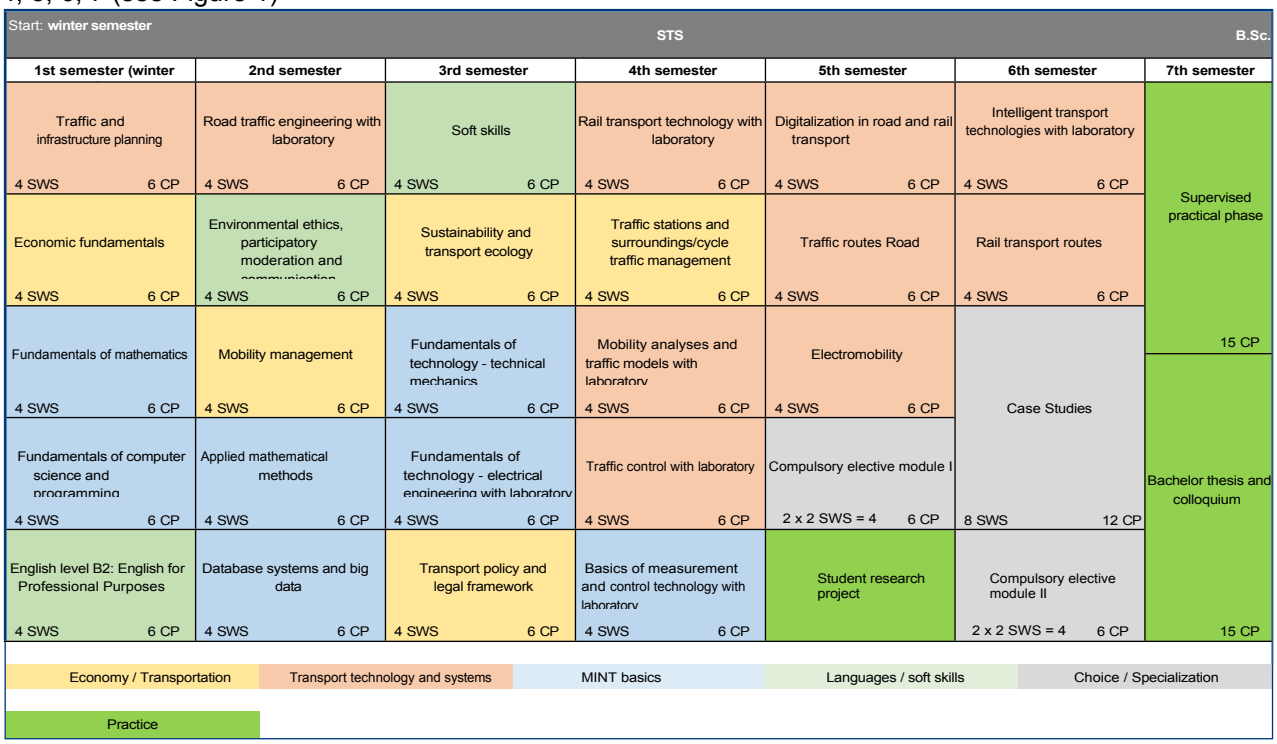

Figure 1: STS study plan for admission to the winter semester

For students who are admitted in the summer semester, the following sequence of module blocks is planned: 2, 1, 4, 3, 6, 5, 7 (see Figure 2)

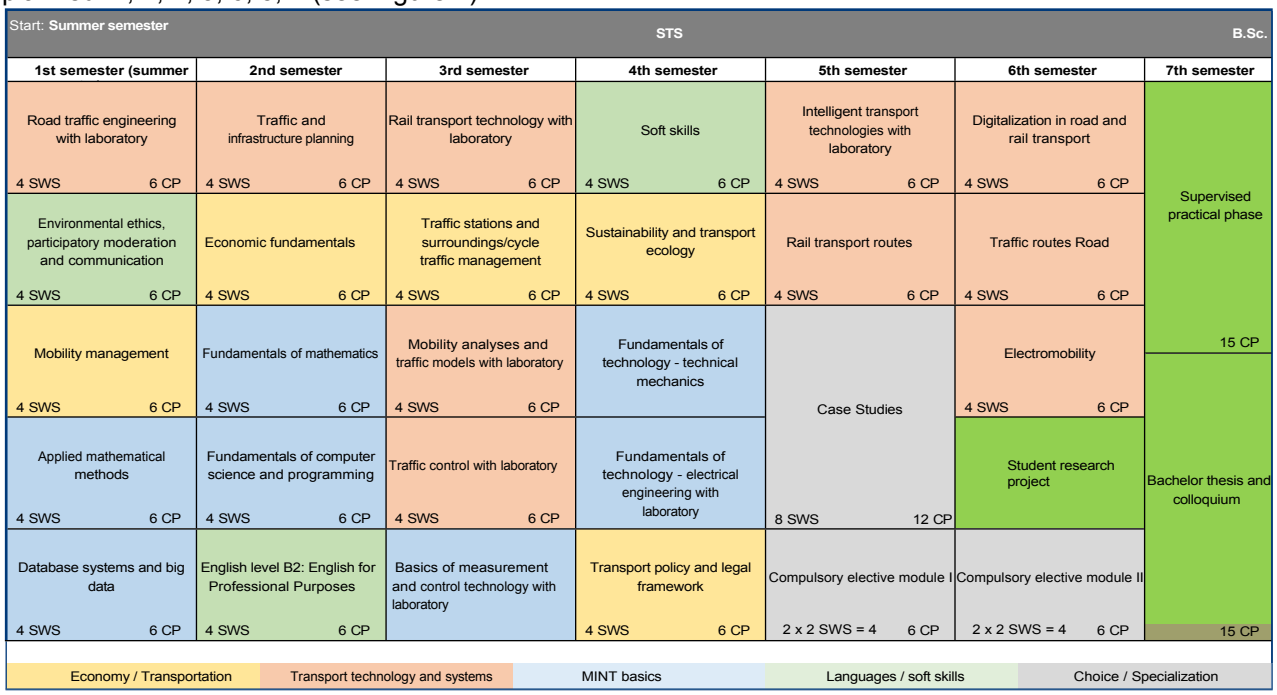

Figure 2: STS study plan for admission to the summer semester

For this reason, the semester position is described in the module descriptions as 1 or 2, 3 or 4 and 5 or 6.

List of abbreviations

General abbreviations:

SWS	Semester hours per week
CP	Credit points according to the European Credit Transfer System (ECTS)

Forms of teaching:

V	Lecture
Ü	Exercise
L	Laboratory
P	practicals
S	Project task
B	Seminar
	support

Forms of examination:

KL	Written exam with duration: KL60 = 60 min., KL90 = 90 min., KL120 = 120 min.
MP	Oral examination
RE	Unit
HA	Term paper
EA	Experimental work
ED	Creation and documentation of computer programs
PA	Project work
PR	Presentation
SA	Student research project
LE	Learning success control
BA	Bachelor thesis
MA	Master thesis
KO	Colloquium

* Links with a plus sign (+) mean that several of the specified examination types are simultaneously part of a module examination and slashes (/) indicate that alternatively one of the specified examination types is used for the module examination.

1. Module block

STS 1 Transport and infrastructure planning

<table>
<tr><td rowspan="4">No:
STS 1</td><td rowspan="3">Compulsory module: Transport and infrastructure planning</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination:
PA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Traffic and infrastructure planning</td><td colspan="2">Prof. Dr. sc. ETH Gerko Santel</td><td>V+Ü</td><td>3+1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

In addition to the concept of transport and mobility, the course deals with the basic concepts of transport and the structuring of the overall transport system as well as sub-transport systems. The main focus is on the characteristics, representation and comparison of transport systems as well as the connections between transport and mobility and the resulting development of traffic.
Both the history of traffic and the current traffic situation are examined. Statistics and traffic forecasts are used for this purpose. Further contents are principles and methodology of traffic planning and planning processes as well as work steps in planning. The basis for this is the description of movement processes in traffic as well as the quantification of the performance of traffic systems and their environmental effects (e.g. noise and air pollutants) and impacts.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing the course, students will have an understanding of the structure of the overall transportation system and know the similarities and differences between the sub-transportation systems. They will be able to evaluate and compare transportation systems in terms of suitability, performance, resource consumption, environmental impact, etc. They have methodological and conceptual skills in transport planning based on the superordinate level of traffic development planning through to concrete traffic object planning.</td></tr>
</table>

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Federal Ministry of Transport and Digital Infrastructure (ed.) (2018): Transport in figures 2018/2019, DVV; Media Group GmbH, Hamburg
- Nobis, C./ Kuhnimhof, T. (2018): Mobility in Germany - MiD results report Study by infas, DLR, IVT and infas 360 on behalf of the Federal Minister of Transport and Digital Infrastructure, Bonn, Berlin. www.mobilitaet-in-deutschland.de
- Schnabel W. / Lohse. D. (2011): Fundamentals of road traffic engineering and road traffic planning, Volume 1: Road traffic engineering; 3rd edition; Beuth Verlag, Berlin/Kirschbaum Verlag, Bonn
- Schnabel W. / Lohse. D. (2011): Fundamentals of road traffic engineering and road traffic planning, Volume 2: Road traffic planning; 3rd edition; Beuth Verlag, Berlin/Kirschbaum Verlag, Bonn

STS 2 Economic fundamentals

<table>
<tr><td rowspan="4">No:
STS 2</td><td rowspan="3">Compulsory module:
Economic fundamentals</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination:
KL60</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Economic fundamentals</td><td colspan="2">Dipl.-Kfm. Carsten Wiljes</td><td>V+Ü</td><td>3+1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents
- Theory formation and models in economics
- Coordination mechanism market and market forms (basic microeconomic contexts)
- Analysis of macroeconomic markets and developments (basic macroeconomic correlations)
- Subject, terms and tasks of business administration
- Performance management functions (procurement, production and sales)
- Management and support functions
- Current challenges and trends in the economy</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught
Students are able to explain the basic economic relationships and master the necessary terminology. They understand how markets work and know the most important behavioral patterns of suppliers and buyers. They are able to interpret selected market data, assess power relations and thus estimate the consequences of individual economic measures. Students will also be able to recognize the relevance of macroeconomic developments for individual companies.

Furthermore, students are familiar with the subject matter of business administration, are able to differentiate between operational functions and explain the value creation process. In particular, they will be able to name the range of tasks of performance management functions and apply selected instruments. They know the management and support functions and can correctly classify their significance in the operational context. Students develop an understanding of operational decision-making processes and critically examine business management concepts and their limits of application.</td></tr>
<tr><td colspan="6">Literature and working materials
Bartling, H., Luzius, F., Fichert, F. (2019): Fundamentals of economics. Introduction to economic theory and economic policy, 18th edition, Vahlen, Munich
Krugman, P., Wells, R. (2017): Economics, 2nd edition, Schäffer-Poeschel, Stuttgart

Mankiw, G., Taylor, M.P. (2021): Grundzüge der Volkswirtschaftslehre, 8th edition, Schäffer-Poeschel, Stuttgart

Schierenbeck, H., Wöhle, C. B. (2016): Grundzüge der Betriebswirtschaftslehre, 19th edition, Munich

Wöhe, G./ Döring, U. (2020): Introduction to General Business Administration, 27th edition, Munich</td></tr>
</table>

STS 3 Fundamentals of mathematics

<table>
<tr><td rowspan="4">No:
STS 3</td><td rowspan="3">Compulsory module:
Fundamentals of Mathematics</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination:
KL60</td></tr>
<tr><td>Prerequisites for participation: effective use of basic calculation rules for simplifying terms and solving equations</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Fundamentals of mathematics</td><td colspan="2">Dipl.-Math. Ingrid Bennecke</td><td>V+Ü</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents
• Real functions of one variable: Types of functions, representations, differential and integral calculus
• Functions of several variables, partial integration, multiple integrals
• Differential equations</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught
Students
• represent relationships between variable quantities using suitable functions.
• know and check the properties of functions.
• determine derivatives and integrals and use these to solve application problems (e.g. extreme value problems, calculation of areas).
• know solution methods for differential equations and use them to solve corresponding equations.</td></tr>
<tr><td colspan="6">Literature and working materials
Own updated lecture materials and exercises (as PDF)
Papula, L., Mathematics for Engineers and Scientists Volume 1+2, Springer Vieweg, Wiesbaden 2018</td></tr>
</table>

STS 4 Fundamentals of computer science and programming

<table>
<tr><td rowspan="4">No:
STS 4</td><td rowspan="3">Compulsory module:
Fundamentals of Computer Science and Programming</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination:
PA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Fundamentals of computer science and programming</td><td colspan="2">Dipl.-Ing. (FH) Marko Apel M.Sc.Eng.</td><td>V+L</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents
Students are introduced to application areas of information systems and the basic structure of computer systems and computer architectures. Various number systems for their use in computer science are motivated and discussed. The basics of programming are then taught. These include
- Data types and operators,
- Algorithms and functions,
- Control structures and
- File input and file output.

In laboratories, the content taught is supplemented with practical examples. A microcontroller-based system (Arduino) using the C programming language is used for this purpose.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught
After successfully completing this module, students know the basic workings of computer and information systems. In addition, they have basic knowledge of programming, which enables them to understand functions and algorithms and to design and implement them themselves.</td></tr>
<tr><td colspan="6">Literature and working materials
Levi, Rembold (2002): Einführung in die Informatik für Naturwissenschaftler und Ingenieure, 4th edition, Carl Hanser Verlag
Precht, Meier, Tremel (2004); Eine Einführung in Theorie und Praxis der modernen EDV, 7th edition, Addison-Wesley-Verlag
Wolf, Krooß (2023): C from A to Z, 5th edition, Rheinwerk Verlag
Bartmann (2014): Discover the electronic world with Arduino, O'Reilly Verlag</td></tr>
</table>

STS 5 English level B2: English for Professional Purposes

<table>
<tr><td rowspan="3">No.
STS 5</td><td rowspan="2">Compulsory module:
English level B2: English for Professional Purposes</td><td colspan="2">Language:
English</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td>Prerequisites for participation: none</td><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: KL60+LE</td></tr>
<tr><td></td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">English level B2: English for Professional Purposes</td><td colspan="2">Dr. phil. Thomas Caplan</td><td>V</td><td>4</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: NaMo and STS</td></tr>
<tr><td colspan="6">Contents Business
English
- Advanced grammar and communication basics
- English vocabulary in economics and business administration
- Strategic thinking
- Motivation and personnel in the company
- Personality traits
- Team spirit and organization
- Entrepreneurship and disruption
- Stakeholder theory
- Corporate Social Responsibility (CSR)</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

Business English
Students will build up a basic vocabulary in business English and gain insights into the "mind of the manager" and the relationship with customers and employees through a variety of tasks and discussions. Students will be able to understand personal development and innovation in business. This seminar deals with the role of ideals in business and the work of a manager and provides an insight into the philosophical background of the term "CSR". Furthermore, the term "customer" will be explored in depth.
and discussed.</td></tr>
<tr><td colspan="6">Literature and working materials Business English
Caplan, Th. (2015): The Distinction of Human Being, Vernon Press, Delaware
Duckworth, M./ Turner, R. (2012): Business Result, upper-intermediate, Oxford
Dubicka, I./ O'keeffe, M. (2016): Market Leader, Advanced, 3rd edition, Pearson, London
Trappe, T./ Tullis , G. (2016): Intelligent Business, Advanced, 5th edition, Pearson, London
Rosenberg, M. (2020): Business Partner, C1 Coursebook, 1st edition, Pearson, London</td></tr>
</table>

2. Module block

STS 6 Road traffic engineering with laboratory

<table>
<tr><td rowspan="3">No:
STS 6</td><td rowspan="2">Compulsory module:
Road traffic engineering with laboratory</td><td colspan="2">Language:
German</td><td>Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td>Semester position: 1 or 2</td></tr>
<tr><td>Prerequisites for participation: none</td><td colspan="2">Workload:
180 h</td><td rowspan="2">Examination form: KL60+EA</td></tr>
<tr><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Road traffic engineering</td><td colspan="2" rowspan="2">Prof. Dr. sc. ETH Gerko Santel</td><td>V+Ü</td><td>2+1</td></tr>
<tr><td colspan="2">Driving dynamics of road vehicles</td><td>L</td><td>1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents
The course deals with basic algae and parameters of traffic flow on roads. On the basis of the variables compared in the so-called fundamental diagram, insights are gained into the performance of the road traffic infrastructure and thus the quality of the traffic flow. In addition, the legal and organizational framework conditions in road traffic are dealt with. Lecture hall exercises are used to provide a practical reference for the course content and to consolidate what has been learned.
The laboratory deals with driving dynamics and the basic principles of vehicle technology. This includes kinematics and dynamics as the basis for describing the longitudinal and lateral movements of vehicles and the forces that occur. Driving dynamics parameters are determined and processed in laboratory tests.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing the course, students will be able to name the essential technical, organizational, legal and operational conditions of road traffic. They will be able to use technical terms correctly and describe technical and operational relationships in road traffic. They will be able to make statements on the efficiency and quality of traffic flow with the help of the interrelationships they have learned.
Successful participation in the laboratory course enables students to determine and interpret basic driving dynamics relationships of the spatio-temporal description of vehicle movements in the operation of road vehicles and the forces that occur. Students will be able to carry out vehicle dynamics calculations and evaluate the results with regard to vehicle design/performance.
The basic skills from this module are taken up again as a basis for further considerations in subsequent modules.</td></tr>
<tr><td colspan="6">Literature and working materials</td></tr>
</table>

Road traffic systems:

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Schnabel W. and D. Lohse: Fundamentals of road traffic engineering and road traffic planning, Volume 1: Road traffic engineering; 3rd edition 2011; Beuth Verlag, Berlin/Kirschbaum Verlag, Bonn
- Road and Transportation Research Association (FGSV): Manual for the Design of Road Traffic Facilities (HBS); 2015 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Notes on the fundamental diagram; 2005 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Motorways (RAA); 2008 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Rural Roads (RAL); 2012 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Urban Roads (RASt); 2006 edition; FGSV-Verlag, Cologne

Driving dynamics of road vehicles:

- Assmann, B.: "Engineering Mechanics, Volume 3: Kinematics and Kinetics", ISBN 978-3-486-59751-6; Oldenbourg Verlag, Munich, 15th edition 2011
- Gabbert, U.; Raecke, I: "Technische Mechanik für Wirtschaftsingenieure", ISBN 978-3-446- 41409-9; Carl Hanser Verlag, Munich, Vienna; 4th updated edition
- Haken, K.-L.: "Grundlagen der Kraftfahrzeugtechnik", ISBN 978-3-446-43527-8; Carl Hanser Verlag, Munich; 3rd updated edition
- Winner, H.; Hakuli, S.; Wolf, G.; "Handbuch Fahrerassistenzsysteme"; ISBN 978-3-8348-1457-9; Vieweg+Teubner Verlag, Springer Fachmedien, Wiesbaden; 2nd edition 2012im Bahnbetrieb", Hamburg 2004

STS 7 Environmental ethics, participatory moderation and communication

<table>
<tr><td rowspan="3">No:
STS 7</td><td rowspan="2">Compulsory module:
Environmental ethics, participatory moderation and communication</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td>Prerequisites for participation: none</td><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form:
KL60/PR/HA</td></tr>
<tr><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Environmental ethics</td><td colspan="2" rowspan="2">Prof. Dr. Jana Kühl</td><td>V+S</td><td>1+1</td></tr>
<tr><td colspan="2">Participatory moderation and communication</td><td>S</td><td>2</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Contents

Environmental ethics
- Basics: What are ethics? Ethical principles
- Meaning and purpose of environmental ethics, basic questions of environmental ethics, environmental ethics and transportation planning
- Applied environmental ethics in questions of transport and mobility
- Environmental ethics and society: cultural contexts, social conventions and right action, ethical questions of social mobility
- Environmental ethics in political and communal action: Environmental ethics in politics, environmental communication and discourse design, political ecology, environmental ethical issues in transportation policy
- Environmental ethics in business and companies: Position of economics, corporate social responsibility, sustainability management in business practice, environmental ethics as a framework for action by transportation companies

Participatory moderation and communication
- Theoretical introduction to moderation, communication and participation
- Meaning of vision, goal, communication, participation and qualification in change processes
- Stakeholder management
- Citizen participation
- Methods and tools
- Planning communication and moderation strategies based on case studies</td></tr>
</table>

Learning objectives and skills to be taught

Environmental ethics
By dealing with environmental ethical perspectives, students gain a critical and reflective view of current events in transport planning and transport policy. Students will be able to classify and evaluate transport issues from an environmental-ethical perspective. They will be able to consider the problems and challenges of transport development from an environmental-ethical perspective and trace the various strands of discourse in ethical negotiations. Students will also be able to develop and justify concepts and solutions based on environmental ethical considerations.

Participatory moderation and communication

Students learn the basics of moderation methods, communication and participation with their objectives, possible applications and methods.
You can lead moderated meetings and ensure a balanced participation of all participants.
Students transfer what they have learned to case studies from different areas and reflect on the selected communication and moderation strategies

Literature and working materials

Environmental ethics

Fenner, D. (2022): Introduction to applied ethics. 2nd, completely revised and expanded edition. Narr Francke Attempto Verlag, Tübingen (UTB Philosophie, 3364).
Ott, K. (2021): Environmental ethics for introduction. 3rd supplemented edition. Junitus publishing house, Hamburg.
Ott, K.; Dierks, J.; Voget-Kleschin, L. (eds.) (2016): Handbook of environmental ethics. J.B. Metzler Verlag, Stuttgart.
Vogt, M.; Ostheimer, J, and F. Uekötter (eds.) (2013): Where does environmental ethics stand? Changing patterns of argumentation. Metropolis Verlag, Marburg.
WGBU (1999):

Participatory moderation and communication

Benighaus, C.; Wachinger, G. (2016): Citizen participation: Konzepte und Lösungswege für die Praxis, Wolfgang Metzner Verlag, Frankfurt am Main
Funcke, A.; Havenith, E. (2019): Moderations-Tools, 6th edition, managerSeminare Verlgs, Bonn
Groß, S. (2018): Moderation skills: Accompanying communication processes in groups in a goal-oriented manner, Springer Gabler , Wiesbaden
Lang, M. et al (2020): Change Management Workbook: Successfully shaping change in the company, Carl Hanser Verlag, Munich
Lundershausen, S.: Moderation and process support in strategic change projects: Basics, methods and instruments for consultants, moderators and decision-makers, managerSeminare, Bonn
Mast, C. (2020): Unternehmenskommunikation: Ein Leitfaden, 8th revised edition, utb Gmbh, Stuttgart

STS 8 Mobility management

<table>
<tr><td rowspan="4">No:
STS 8</td><td rowspan="3">Compulsory module:
Mobility management</td><td colspan="2">Language:
German/ English</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td colspan="2">Workload: 180 h</td><td colspan="2" rowspan="2">Form of examination:
PA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Theory, goals and fields of application of mobility management</td><td colspan="2">Prof. Dr. Jana Kühl</td><td>V+S</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: NaMo</td></tr>
<tr><td colspan="6">Contents

Theory, objectives and fields of application
- Conceptual understanding, approaches and methods
- Contextualization in current social and political debates, Political and social goals of mobility management
- Analysis tools and fields of application in mobility management
- Fields of application in various institutional and socio-economic contexts
- Identification of stakeholders and stakeholder groups in mobility management
- Basics of strategic communication
- Cause-effect principles of mobility management
- Synergetic consulting options (e.g. health, energy, housing, education)
- Urban development and urban planning contexts of mobility management (e.g. Neighborhood management, mobility centers)</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught
Students will be able to name the basic objectives and processes of mobility management. They are able to describe procedures, fields of application and methods in mobility management and classify them in terms of their effects. Students will also be able to develop context-specific conceptual approaches in mobility management and identify implementation steps.</td></tr>
<tr><td colspan="6">Literature and working materials

Blees, Volker; Vogel, Jens; Wieskotten, Greta: School mobility management

Blees, Volker; Bruns, André; Stiewe, Mechthild: Mobility management - from wallflower to success factor for sustainable mobility

Brög, Werner; Erl, Erhard; Ker, Ian; Ryle, James; Wall, Rob: Evaluation of voluntary behavior change: Experiences from three continents

German Energy Agency (dena), effizient mobil - Das Aktionsprogramm für Mobilitätsmanagement Finke,

Timo: Wirkungen von Mobilitätsmanagement-Programmen - Entwicklung eines</td></tr>
</table>

Evaluation procedure

Road and Transportation Research Association (FGSV): Mobility Marketing - FGSV Working Paper No. 66

Road and Transportation Research Association (FGSV: EAM - Recommendations for the application of mobility management

Kemming, Herbert; Reutter, Ulrike; Stiewe, Mechthild; Benden, Jan; Brandt, Tobias; Witte, Andreas; Bruns, André, Mühlhans, Heike, Mobility Management in Urban Planning - Final Report FOPS 70.794

Langweg, Armin: Mobility management, mobility culture, marketing & mobility marketing - an attempt to explain the terms

Louen, Conny: Impact assessment of mobility management - starting points for modeling & deriving potentials and effects using the example of corporate mobility management

Marsden Jacobs Associates (MJA): Evaluation of the TravelSmart Local Government and Workplace Programs

Mittelstandsinitiative Energiewende und Klimaschutz: Practical guide to corporate mobility management

Nanz, Patrizia; Fritsche, Miriam: Citizen participation handbook - procedures and players, opportunities and limits

Schwedes, Oliver; Sternkopf, Benjamin; Rammert, Alexander: Mobility Management in Germany - A Critical Review - Discussion Paper

Schwedes, Oliver; Sternkopf, Benjamin; Rammert, Alexander: Mobility management - possibilities and limits of transport policy design using the example of mobility management

Swiss Association for Standardization (SNV): Mobility management systems - Requirements with instructions for use

Stiewe, Mechthild; Reutter, Ulrike: Mobility management - scientific principles and effects in practice

Walther, Sabrina; Kistner, Rafael; Arnold, Alina; Kowald, Matthias; Bruns, André: Evaluation strategies and monitoring instruments for the Hesse Mobility Strategy 2035 and the Hessian Local Mobility Strategy - Final report on the Mob Eval research project

STS 9 Applied mathematical methods

<table>
<tr><td rowspan="4">No:
STS 9</td><td rowspan="3">Compulsory module:
Applied mathematical methods</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination:
KL60</td></tr>
<tr><td>Prerequisites for participation: effective use of basic calculation rules for simplifying terms and solving equations</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Applied mathematical methods</td><td colspan="2">Dipl.-Math. Ingrid Bennecke</td><td>V+Ü</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents
• Geometry: Pythagoras, angle measures, angle functions
• Complex numbers
• Linear algebra: vectors, matrices, LGS
• Statistics: Samples, random variables, mean values, measures of dispersion, normal and binomial distribution, inductive statistics</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught
Students
• state complex numbers in different representations and determine sums/products/quotients/powers.
• calculate with vectors and interpret scalar product and vector product.
• describe straight lines in the plane/planes in space.
• calculate with matrices.
• solve LGS.
• determine probabilities in random experiments.
• determine key figures of a sample/probability distribution.
• draw conclusions from the entirety to a sample and vice versa.</td></tr>
<tr><td colspan="6">Literature and working materials
Own updated lecture materials and exercises (as PDF)
Papula, L., Mathematics for Engineers and Natural Scientists Volumes 1-3, Springer Vieweg, Wiesbaden 2018</td></tr>
</table>

STS 10 Database systems and big data

<table>
<tr><td rowspan="3">No:
STS 10</td><td rowspan="2">Compulsory module:
Database systems and big data</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 1 or 2</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination:
KL60</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Database systems and big data</td><td colspan="2">Dipl.-Ing. (FH) Marko Apel M.Sc.Eng.</td><td>V+L</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

Databases form the backbone of numerous internet-based services and systems. In this course, students learn about the basics of databases, including definitions and architecture of databases as well as conceptual design and modeling with relational databases. The concept of data storage is becoming established in more and more systems. Students learn how to handle big data in corresponding databases and systems in order to master growing data volumes, e.g. via technical systems. In the further course of the course, they consolidate their knowledge using selected practical examples using SQL.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing this course, students are familiar with database systems and have gained experience in the practical use of databases. They will be able to design database-based systems, design the corresponding databases and put them into operation. In addition, they know what needs to be considered when dealing with large amounts of data in databases.</td></tr>
<tr><td colspan="6">Literature and working materials

Own documents
Elmasri, Navathe (2009): Fundamentals of database systems, 3rd edition, Pearson Studium Date (2003): An introduction to database systems, Pearson
Seven (2018): Oracle SQL Das umfassende Handbuch, 3rd edition, Rheinwerk Computing</td></tr>
</table>

3. Module block

STS 11 Soft skills

<table>
<tr><td rowspan="4">No:
STS 11</td><td rowspan="3">Compulsory module:
Soft skills</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: HA + PR</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h.</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Scientific work</td><td colspan="2" rowspan="2">Dipl.-Ök. Anja Borchers</td><td>V+Ü</td><td>1 + 1</td></tr>
<tr><td colspan="2">Presentation and conflict management</td><td>S</td><td>2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
</table>

Contents

Scientific work

- Definition and importance of scientific work
- Types of scientific work
- Literature research, topic identification, hypothesis formation
- Outline creation, structure of scientific papers
- content and formal guidelines (e.g. citation style, text layout, creation of indexes).
- Methods of time and self-management, stress prevention and self-motivation

Presentation

- Definition of the term "presentation", clarification of the presentation objective
- Selection and structuring of content
- Principles/possibilities of visualizations
- Use of media
- Dealing with difficult situations (stage fright, questions, objections, breakdowns)
- Presentation with subsequent discussion/reflection
-

Conflict management

- Definition, emergence and progression (escalation stages) of conflicts
- Causes of conflict, types of conflict in the company
- Conflict resolution strategies and prevention
- Procedure of a conflict resolution meeting (theory and role play)

Learning objectives and skills to be taught

In this module, students acquire important methodological and social skills for later specialist and management tasks.

Scientific work

In the sub-area "Scientific work", students should become familiar with the basic principles of scientific work. They acquire content-related and methodological knowledge of academic work in order to be able to prepare their own academic work correctly, i.e. they are able to work on a topic or problem according to academic standards and principles. Furthermore, they learn methods of learning and prioritization, time and task planning and how to apply and reflect on their own study situation.

Presentation

With the help of the acquired basic knowledge on the subject of "Presentation" as well as the various practical exercises within the course, students are then able to prepare and give an effective presentation.

Conflict management

Participants in this sub-module acquire basic skills in the area of conflict management. They will be able to recognize conflicts and their causes at an early stage and select an appropriate conflict resolution strategy depending on the level of escalation. They also learn how to conduct and reflect on constructive conflict discussions.

Literature and working materials Scientific work

- Esselborn-Krumbiegel, H. (2022): Correct scientific writing: Scientific language in rules and exercises, 7th ed., UTB Verlag Paderborn
- Franck, N./Stary, J. (2013): The technique of scientific work, 17th edition, Schöningh, Paderborn
- Riedenauer, M.; Tschirf, A. (2022): Time management and self-organization in science, 2nd completely revised and updated ed. facultas Verlag, Vienna
- Stickel-Wolf, C. (2022): Wissenschaftliches Arbeiten und Lerntechniken: Erfolgreich studieren - gewusst wie!, 10th updated and expanded edition, Springer Gabler Verlag, Wiesbaden
- Theisen, M. R. (2021): Scientific work: Erfolgreich bei Bachelor- und Masterarbeit, 18th newly revised and abridged edition, Vahlen Verlag, Munich

Presentation

- Hartmann, M./ Funk, R./ Nietmann, H. (2018): Presenting: Presentations: goal-oriented, addressee-oriented, sustainable, 10th revised edition, Basel: Beltz Verlag, Weinheim
- Schulz von Thun, F. (2016): Miteinander Reden 1 - Störungen und Klärungen, 53rd edition (original edition), Rowohlt Taschenbuch Verlag, Reinbek bei Hamburg
- Schulz von Thun, F./ Ruppel, J./ Stratmann, R. (2017): Miteinander Reden: Kommunikationspsychologie für Führungskräfte, 17th edition (original edition), Rowohlt Taschenbuch Verlag, Reinbek bei Hamburg
- Seifert, J. W. (2015): Visualize - Present - Moderate, 35th edition, Gabal Verlag, Offenbach

Conflict management

- Freitag, S., Richter, J. (eds.) (2019): Mediation - das Praxisbuch: Denkmodelle, Methoden und Beispiele, 2nd completely revised edition, Basel: Beltz Verlag, Weinheim
- Glasl, F. (2020): Konfliktmanagement, Ein Handbuch für Führungskräfte, Beraterinnen und Berater, 12th updated edition, Haupt Verlag, Bern
- Rosenberg, M. B. (2016): Gewaltfreie Kommunikation, 12th revised and expanded. Edition, Junfermann Verlag, Paderborn
- Schwarz, G. (2014): Konfliktmanagement: Konflikt erkennen, analysieren, lösen, 9th ed., Springer Gabler, Wiesbaden

STS 12 Sustainability and transport ecology

<table>
<tr><td rowspan="3">No:
STS 12</td><td rowspan="2">Compulsory module:
Sustainability and transport ecology with laboratory</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td>Prerequisites for participation: none</td><td colspan="2">Workload:
180 hrs.</td><td colspan="2" rowspan="2">Examination form: KL60 + PA</td></tr>
<tr><td>Presence:
60 hrs.</td><td>Self-study:
120 hrs.</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Lecture Transport Ecology</td><td colspan="2" rowspan="3">Prof. Sven Strube</td><td>V</td><td>2</td></tr>
<tr><td colspan="2">Traffic Ecology Laboratory</td><td>L</td><td>1</td></tr>
<tr><td colspan="2">Lecture on sustainability</td><td>V</td><td>1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS and NaMo</td></tr>
<tr><td colspan="6">Contents

Transport ecology
1. Introduction
2. Mobility versus the environment
3. Traffic noise
4. Pollutants
5. Alternative fuels and drives
6. Life cycle assessment
7. Energy consumption
8. Land use
9. External costs
10. Mobility of the future

Sustainability
1. Terminology, concepts and contexts
2. Requirements and goals of sustainability in mobility
3. Sustainability policy and transport policy
4. Discourses, strategies, guidelines in application to mobility issues
5. Conflicts of interest
6. Good Practice</td></tr>
</table>

Learning objectives and skills to be taught

Transport ecology
The aim is to provide students with knowledge in the field of transport ecology and to gradually introduce them to the necessary basics and terminology. Students are sensitized to a holistic understanding of the interactions between the environment and traffic.
After completing the course, students will have developed a sound understanding of the concepts of transport ecology. They have methodological and conceptual skills with regard to the interrelationships between transportation and the environment, can create emission balances and apply methods of sustainability in theory and practice.
Sustainability
The aim is to provide students with knowledge of the interrelationships and requirements of sustainability in the field of transportation and mobility. Students develop a differentiated understanding of the concept of sustainability and learn how sustainability requirements are negotiated and implemented in politics and transportation. They acquire conceptual skills for the critically-reflective classification of transport measures under sustainability requirements. They will also be able to integrate sustainability aspects into transport considerations and apply them in a solution-oriented manner.

Literature and working materials
Literature and working materials as well as competent contact persons will be presented and named during the event.

STS 13 Technical Fundamentals - Technical Mechanics

<table>
<tr><td rowspan="4">No:
STS 13</td><td rowspan="3">Compulsory module:
Fundamentals of Technology - Technical Mechanics</td><td colspan="2">Language:
German</td><td>Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td>Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td rowspan="2">Form of examination:
KL60</td></tr>
<tr><td>Prerequisites for participation:
Fundamentals of mathematics</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Technical mechanics</td><td colspan="2">Prof. Dr. sc. ETH Gerko Santel</td><td>V+Ü</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

The module begins with a classification of technical mechanics in physics. As an important foundation of technology, its importance is constantly increasing due to the ongoing expansion of its areas of application. It deals with the description and prediction of the movement of bodies and the forces associated with these movements. The module is divided into three blocks: Statics, Elastostatics and Kinematics/Dynamics.
In the area of statics, in addition to the basic concepts, forces with a common point of application, general force systems and equilibrium of the rigid body as well as adhesion and friction are dealt with.
The mathematical basics of vectors and systems of equations are required.
Elastostatics focuses on the statics of elastically deformable bodies, looking at simple stress states and important cases in practice. The third block deals with kinematics, i.e. the theory of geometric and temporal motion sequences, without addressing forces as the cause or effect of motion. Dynamics, on the other hand, deals with the interaction of forces and movements.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

Students acquire the basic engineering skills in the field of technical mechanics that are required, among other things, to understand the functioning of transport systems and to work on design or optimization problems of subsystems or components.</td></tr>
<tr><td colspan="6">Literature and working materials

Gross, D.; Hauger, W.; Schröder, J. ; Wall, W.A. (2019): Engineering Mechanics 1 - Statics, 14th edition, ISBN 978-3-662-59156-7, Springer-Verlag, Berlin/Heidelberg
Gross, D.; Hauger, W.; Schröder, J. ; Wall, W.A. (2021): Engineering Mechanics 2 - Elastostatics, 14th edition, ISBN 978-3-662-61861-5, Springer-Verlag, Berlin/Heidelberg
Gross, D.; Hauger, W.; Schröder, J. ; Wall, W.A. (2019): Engineering Mechanics 3 - Statics, 14th edition, ISBN 978-3-662-59550-3, Springer-Verlag, Berlin/Heidelberg

Further working materials will be provided during the event.</td></tr>
</table>

STS 14 Technical Basics - Electrical Engineering with Laboratory

<table>
<tr><td rowspan="4">No:
STS 14</td><td rowspan="3">Compulsory module:
Technical basics - electrical engineering with laboratory</td><td colspan="2">Language:
German</td><td>Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td>Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td rowspan="2">Examination form: KL
60+EA</td></tr>
<tr><td>Prerequisites for participation:
Fundamentals of mathematics</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Electrical engineering with laboratory</td><td colspan="2">Prof. Dr.-Ing. Marco Brey</td><td>V+L</td><td>3+1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
</table>

Contents

This course teaches the basics of electrical engineering with a focus on energy storage, direct and alternating current circuits, filter and pass circuits and the principles of network calculation. Fundamental terms such as field, potential and work and their general meaning are introduced. The properties of electrical circuits are explained both for
direct and alternating current. The time-dependent behavior of characteristic variables is described for practically relevant arrangements. Traffic-relevant applications of electrical engineering, energy storage and energy conversion are discussed.
The questions of planning and evaluation of measurement data relevant to the execution of experiments are introduced using the electrical engineering examples and the transfer to general questions is shown.

Learning objectives and skills to be taught

Students learn basic methods for calculating static and time-dependent electrical systems. They are given an overview of current developments in the fields of electrical engineering and the use of electrical energy, so that they can understand and explain interrelationships. Another learning objective is to be able to understand and explain the functionality of simple electrical circuits. You will gain an insight into the planning and execution of experiments as well as the evaluation of measurement series and assessment of the results.

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Höwing, Mareike (2019): Introduction to Electrical Engineering, 1st edition, Rheinwerk Verlag Bonn, ISBN 978-3-8362-6653-6
- Wichmann, Klaus (2014): Evaluation of measurement data, 1st edition, DeGRuyter Oldenbourg, ISBN 978-3-4868-4418-4

STS 15 Transport policy and legal framework

<table>
<tr><td rowspan="3">No:
STS 15</td><td rowspan="2">Compulsory module: Transport policy and legal framework</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form:
PA/RE/KL60</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Transport policy</td><td colspan="2" rowspan="2">Prof. Dr. Dirk Trost</td><td>V+S</td><td>1+1</td></tr>
<tr><td colspan="2">Legal framework</td><td>V</td><td>2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

<u>Transport policy:</u>
- Fundamentals of political science
- Historical outline and classification of national and international transport policy,
- Position of the transport industry in the national economy, transport policy as a scientific discipline and shaping factor,
- Supporting bodies, objectives and decision-making processes in politics, in particular national and international transport policy
- Elements of transport policy practice
- Selected fields of action and aspects of competition and transport policy,
- Processing, presentation and discussion of transport policy issues

<u>Legal framework:</u>
- Importance of legal requirements for public transport
- Differentiation between private and public engagement
- Key points and main features of the legal bases in the public law area with special reference to public transport and standardization.
- Responsibilities of various players
- Presentation of selected statutory processes such as approval procedures or planning requirements with legal bases
- Presentation and discussion of current legal problem areas, such as functional safety and autonomous driving with liability risks.
- Processing and solving suitable case constellations</td></tr>
</table>

Learning objectives and skills to be taught

Transport policy:
At the end of this module, students will be familiar with the main tasks and structures as well as the functioning, instruments and measures of economic and transport policy in Germany as well as internationally - with a focus on the European Union. Students will be able to assess the connections between transport policy programs and their implementation in the overall social and economic context and discuss them critically with regard to the achievement of objectives.
Students learn to apply this knowledge to a given current topic from economic and transport policy, to present the chosen topic appropriately and clearly and to put it up for discussion. The students are then able to analyze concrete economic and transport policy measures and to assess their quality of implementation as well as their macroeconomic and microeconomic effects and to critically question them from different perspectives. They discuss their topic with other students and reflect on their own role.

Legal framework:
By completing this sub-module, students will be familiar with the essential legal foundations of public transport. The understanding gained from the transport policy module helps students to understand the development process, objectives and institutional responsibilities as well as the interaction of legal requirements. Students also recognize the effects of laws and regulations on business management and liability law, especially in situations where technical and legal aspects influence each other, such as functional safety and autonomous driving or planning law requirements.
Students will then have mastered the key legal principles and risks arising from their field of activity. In particular, they will be able to classify these in the context of political or state action. The processing and analysis of sample cases support these learning objectives.

Literature and working materials

Transport policy:
Own lecture and working materials (provided as pdf documents) as well as the topic-specific literature required for the respective papers

Banister, D. et al. (2002): Transport Policy and the Environment, London

Donges, J.-B., Freytag, A. (2009): General Economic Policy, 3rd revised and expanded edition, Stuttgart

Frerich, J., Müller, G. (2004): European transport policy. From the beginnings to the eastward enlargement of the European Union. Politisch-ökonomische Rahmenbedingungen - Verkehrsinfrastrukturpolitik 1, Oldenbourg-Verlag, Munich

Fichert, F., Grandjot, H.H. (2007): Actors, objectives and instruments, in: Schöller, O./Canzler, W./Knie, A. (eds.): Handbuch Verkehrspolitik, Wiesbaden, pp. 138 - 160

Grandjot, H.-H., Bernecker T. (2014): Transport policy - basics, functions and perspectives for science and practice, Hamburg

Schwedes, O. (2018): Transport policy - An interdisciplinary introduction, 2nd edition, Wiesbaden

Schwedes, O., Canzler, W., Knie, A. (editors) (2015): Handbuch Verkehrspolitik, 2nd edition, Wiesbaden

Stock, W., Bernecker, T. (2014): Verkehrsökonomie: Eine volkswirtschaftlich-empirische Einführung in die Verkehrswissenschaft, Wiesbaden

Stopher, P., Stanley, J. (2014): Introduction to Transport Policy: A Public Policy View, Cheltenham

Legal framework:

Legal bases and legal texts from national legislation concerning public transport, latest version,
Various EU directives and regulations on (public) transport, latest versions in each case

Essays or commentary literature:

- Badenhausen-Fähnle, Elisabeth: The legal framework for strengthening cycling in the transport transition in DÖV 2023, 160 ff.
- Bodungen, Benjamin von; Gatzke, Sophie: Legislative milestones on the road to autonomous driving - overview of the latest developments in German, European and international law in RDi 2022, 354 ff.
- Deusch/Eggendorfer in Taeger/Pohle, Computerrechts-Handbuch, version: 37th EL May 2022, para. 450 m) autonomous driving, smart car.
- Grundmann in MüKoBGB/Grundmann, 9th ed. 2022, BGB § 276 para. 112, 113 b) Private and state standards of conduct.
- Grundmann in MüKoBGB/Grundmann, 9th ed. 2022, BGB § 276 para. 147, 148, e) Automated and autonomous driving (with production of the vehicles).
- Haupt, Tino: The Regulation on the Autonomous Driving Act in NVZ 2022, 166 ff.
- Helmig: ISO 26262 - Functional safety in passenger vehicles: On the responsibility of functional safety managers in InTer 2013, 28 ff.
- Klett/Gehrmann: Security flaws in software - software manufacturer's responsibility in MMR 2022, 435 et seq.
- Sedlmaier, Felix; Krzic Bogataj, Andreja: Liability for (partially) autonomous driving in NJW 2022, 2953 ff.
- Seufert, Julia: Who drives - man or machine? in NZV 2022, 319 ff.
- Seyda, Linda: The law on autonomous driving in ZD-Aktuell 2021, 0536.

Further literature and working materials will be presented and named during the course.

4. Module block

STS 16 Rail transport technology with laboratory

<table>
<tr><td rowspan="4">No:
STS 16</td><td rowspan="3">Compulsory module: Rail transport technology with laboratory</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: KL
60+EA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Rail transport technology with laboratory</td><td colspan="2">Prof. Dr.-Ing. Marco Brey</td><td>V+L</td><td>3+1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

The course will deal with the development of the wheel/rail system, the associated system features and system technology fundamentals. The current legal and organizational framework conditions in the German and especially in the European context will be discussed. The basic structure of traction units, drive and braking systems, rail vehicles for passenger and freight transport and their fields of application, the basics of regulating and securing train operations, forms of production in freight and passenger transport, technologies and operating procedures, e.g. in combined transport, are covered. The supplementary laboratory deals with the essential dynamic properties of rail vehicles. Which tractive and resistance forces occur and which performance characteristics can be derived from them, which requirement profiles can be implemented. Using a computer-based simulation program, key parameters such as limit loads, energy consumption and travel times can be systematically determined and checked.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing the course, students will be able to name the essential technical, organizational, legal and operational boundary conditions of rail transport and will have acquired the correct use of technical terms. Students will be able to justify appropriate, economically and socially justifiable areas of application for rail transportation systems based on the technical characteristics of vehicles and infrastructure. After successfully completing the laboratory course, students will have knowledge of the basic driving dynamics of the spatio-temporal description of vehicle movements in rail vehicle operation and the forces involved.
Students can evaluate vehicle dynamics calculations and the results in terms of vehicle design/performance.</td></tr>
</table>

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Jänsch, Eberhard (ed.) (2016): Handbook: The railroad system, Eurailpress, ISBN 978-3-87154-511-5
- Janicki, Jürgen (2022): Systemwissen Eisenbahn, 3rd edition, Bahn Fachverlag, ISBN 978-3- 943214-30-7
- Janicki, Jürgen; Reinhard, Horst; Rüffer, Michael (2020): Schienenfahrzeugtechnik, 4th edition, DB-Fachbuch, Bahn-Fachverlag, ISBN 978-3-943214-26-0
- Gert Heister/Jörg Kuhnke/Carsten Lindstedt/Roswitha Pomp/Thorsten Schaer/Thomas Schill/Stephan Schmidt/Norbert Wagner/Wolfgang Weber (2006): Railroad Operating Technology,
  1st edition, Bahn Fachverlag, ISBN 978-3-943214-35-2
- Ihme, J. (2016): "Schienenfahrzeugtechnik", Wiesbaden, Springer Vieweg, ISBN 978-3-658- 13540-9
- Breuer, Bert; Bill, Karlheinz H. (2017): Bremsenhandbuch - Grundlagen, Komponenten, Systeme, Fahrdynamik, Wiesbaden, Springer Vieweg, ISBN 978-3-658-15488-2
- IVE, University of Hanover (ed.) (2018) "Handbuch Dynamis - Fahrdynamische Berechnungen beliebiger Zugkonfigurationen", Version 2.1, Hanover

STS 17 Traffic stations and surroundings/ cycle traffic management

<table>
<tr><td rowspan="4">No:
STS 17</td><td rowspan="3">Compulsory module: Traffic stations and surroundings/ cycle traffic management</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: MP+PA/ RE</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Planning of traffic stations and surroundings</td><td colspan="2" rowspan="2">Prof. Dr.-Ing. Christoph J. Menzel</td><td>V</td><td>2</td></tr>
<tr><td colspan="2">Cycling traffic management</td><td>V+Ü</td><td>1+1</td></tr>
</table>

Contents:

Planning of traffic stations with surroundings

Classification of variants and sub-variants of transport stations according to means of transport, modes of transport, uses and purposes. Focus on track-guided transport systems (stations, stops, stops) and their interfaces with other modes of transport (road, water, air). Analysis and independent reflection on practical examples to identify the strengths and weaknesses of the structural, urban and sustainable design of corresponding facilities (including the use of materials, energy self-sufficiency, accessibility)

Cycling traffic management

Contexts, objectives and requirements of cycling promotion,
Differentiation of cycling solutions in urban, suburban and rural areas Knowledge and application of planning principles and regulations
Measures to optimize cycling facilities, network planning, service design The bicycle in intermodal and multimodal transport systems
Bike logistics, commercial bike use and new markets Communication,
participation and conflict resolution

Learning objectives and skills to be taught

Planning of infrastructure and stationary systems

Upon successful completion, students will have methodological and conceptual skills in all areas of planning, dimensioning and operational design of traffic facilities and their surroundings. They know the basics of system planning and apply these in theory and practice in a reflective manner.

Cycling traffic management

Students are enabled to design cycling services as part of sustainable transportation systems in a goal-oriented manner. They acquire the tools to develop integrated and user-oriented cycling solutions in a wide range of application scenarios and know the necessary steps to implement innovative approaches to transform urban and rural mobility.

Literature and working materials Planning traffic stations with surroundings

Monheim, H. (2017): Wege zur Fahrradstadt: Analysen und Konzepte. VAS-Verlag für Akademische Schriften, Bad Homburg.
Graf, T. (2016) Handbuch: Radverkehr in der Kommune: Nutzertypen, Infrastruktur, Stadtplanung. Thiemo Graf Verlag, Röthenbach an der Pegnitz.
Meschik, M. (2008): Planning manual for bicycle traffic. Springer-Verlag, Vienna.

Schwedes, O. (2018): Transport policy. An interdisciplinary introduction. VS publishing house for social sciences, Wiesbaden. Further literature and working materials will be presented and named during the course.

The latest literature and working materials as well as competent contact persons will be presented and named during the event.

STS 18 Mobility analyses and traffic models with laboratory

<table>
<tr><td rowspan="3">No:
STS 18</td><td rowspan="2">Compulsory module:
Mobility analyses and traffic models with laboratory</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td>Prerequisites for participation: none</td><td colspan="2">Workload:
180 h
Presence:
60 h
Self-study:
120 h</td><td colspan="2">Examination

form: KL60+EA</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Mobility analyses and traffic models</td><td colspan="2" rowspan="2">Prof. Dr. sc. ETH Gerko Santel</td><td>V+Ü</td><td>1+1</td></tr>
<tr><td colspan="2">Surveys and models</td><td>L</td><td>2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS and NaMo</td></tr>
<tr><td colspan="6">Contents

In addition to the concept of mobility and the causes of mobility, the course deals with the parameters of traffic flow on roads. Essential contents are methods and measurements in the field of mobility. This also includes computer-aided traffic surveys. The analysis of mobility data is based on this content. Traffic models in traffic planning and traffic engineering are discussed on the basis of exemplary questions. Aggregated and disaggregated traffic models are considered, differentiated according to model typology. One focus is on multi-stage traffic models consisting of the stages of traffic generation, traffic distribution, mode choice and traffic route choice</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing the course, students will be familiar with problems, scope for action, methods, procedures and instruments in the areas of mobility analysis, traffic surveys and traffic models. From the methods and concrete case studies presented, procedures can be classified and the appropriate areas of application of various elements and instruments can be derived. Students are able to independently prepare and carry out traffic surveys or supervise their implementation and evaluate the collected data and prepare it for traffic demand modeling</td></tr>
</table>

Literature and working materials

- Bosserhoff, D. (2019): Program Ver_Bau, estimation of traffic volume through urban land use planning projects, program manual; Gustavsburg
- Own, updated, comprehensive lecture materials (provided as PDF files)
- Road and Transportation Research Association (FGSV) (2012): Recommendations for traffic surveys (EVE); FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV) (2005): Notes on the fundamental diagram; FGSV-Verlag, Cologne
- Friedrich, M. / Schiller, C. (2009): Modeling of transport supply and demand, course material; Dresden
- Nobis, C./ Kuhnimhof, T. (2018): Mobility in Germany - MiD results report Study by infas, DLR, IVT and infas 360 on behalf of the Federal Minister of Transport and Digital Infrastructure, Bonn, Berlin. www.mobilitaet-in-deutschland.de
- various software manuals from PTV AG, Karlsruhe
- Schnabel W. / Lohse. D. (2011): Fundamentals of road traffic engineering and road traffic planning, Volume 1: Road traffic engineering; 3rd edition; Beuth Verlag, Berlin/Kirschbaum Verlag, Bonn

STS 19 Traffic control with laboratory

<table>
<tr><td rowspan="4">No:
STS 19</td><td rowspan="3">Compulsory module:
Traffic control with laboratory</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination

form: KL60+EA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Traffic control</td><td colspan="2" rowspan="2">Prof. Dr. sc. ETH Gerko Santel</td><td>V+Ü</td><td>1+1</td></tr>
<tr><td colspan="2">Traffic control laboratory</td><td>L</td><td>2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

The course deals with traffic control in road traffic. This includes in particular the traffic flow at junctions with and without traffic signal control as well as the associated procedures for determining performance. The course also covers the theoretical basics of programming traffic signal systems. Lecture hall exercises are used to provide a practical reference for the course content and to consolidate what has been learned.
In the laboratory, LSA programs are created and tested with the help of relevant commercial software products. The results are interpreted and processed.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing the course, students will have mastered the technical systems of Road traffic control and its application as important instruments for ensuring safety,
Quality of service and economic efficiency in traffic under variable operating conditions. Successful participation in the laboratory course enables students to create LSA programs using relevant software products and to evaluate their performance.</td></tr>
</table>

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Schnabel W. and D. Lohse: Fundamentals of road traffic engineering and road traffic planning, Volume 1: Road traffic engineering; 3rd edition 2011; Beuth Verlag, Berlin/Kirschbaum Verlag, Bonn
- Road and Transportation Research Association (FGSV): Manual for the Design of Road Traffic Facilities (HBS); 2015 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for traffic signal systems (RiLSA); 2010 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Motorways (RAA); 2008 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Rural Roads (RAL); 2012 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Urban Roads (RASt); 2006 edition; FGSV-Verlag, Cologne

STS 20 Fundamentals of measurement and control technology with laboratory

<table>
<tr><td rowspan="4">No:
STS 20</td><td rowspan="3">Compulsory module:
Basics of measurement and control technology with laboratory</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 3 or 4</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: KL60+EA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Basics of measurement and control technology with laboratory</td><td colspan="2">Prof. Dr.-Ing. Tamás Kurczveil</td><td>V+L</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents
Students learn about different types of sensors and physical measurement principles. In addition, specific designs and characteristics of sensors and their areas of application in an industrial context are presented. Measurement methods as well as the basics of transmission, processing and evaluation of measurement signals and the analysis of errors are covered.
Building on this, the basics of control engineering are taught. This includes the basic structure of control loops (controller, controlled system, feedback, cascade controller, multi-variable control), specific types of controllers (two-point controller, PID controller) and their operating strategies (anti-reset windup) as well as the analysis of control loops (process/system stability, design and parameterization of controllers, frequency/time range).
In various laboratories, students will apply what they have learned to practical examples, such as the physical measuring principle of the strain gauge, the structure and parameterization of a temperature control system and the determination of the parameters of a spring (spring constant) by means of vibration analysis.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught
After successfully completing this course, students will be able to select the necessary measurement technology and sensors for specific requirements and applications. In addition, they will be familiar with the principle of control loops and will be qualified to select and design specific controllers for various technical systems and processes. You will have consolidated your knowledge in laboratories on specific applications.</td></tr>
<tr><td colspan="6">Literature and working materials
Thomas Mühl: Introduction to electrical measurement technology: basics, measurement methods, devices. Vieweg+Teubner, 2008.
Wolfgang Schneider: Praktische Regelungstechnik: Ein Lehr- und Übungsbuch für Nicht-Elektrotechniker. Vieweg+Teubner, 2008.
Berthold Heinrich: Fundamentals of control engineering: Simple exercises, practical examples and complex tasks. Springer Vieweg, 2021.
Jan Lunze: Regelungstechnik 1: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiger Regelungen. Springer Vieweg, 2020.
Hans-Jürgen Gevatter: Automation Technology 1: Measurement and Sensor Technology. Springer, 2000</td></tr>
</table>

5. Module block

STS 21 Digitalization in road and rail transport with laboratory

<table>
<tr><td rowspan="3">No:
STS 21</td><td rowspan="2">Compulsory module:
Digitalization in road and rail transport</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td>Prerequisites for participation: -</td><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form:
KL60 / KL30+EA / MP+EA</td></tr>
<tr><td></td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Digitalization in road and rail transport</td><td colspan="2">Prof. Dr.-Ing. Marco Brey</td><td>V+L</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

Students are given an overview of digital applications and the use of digital technologies in road and rail transportation. To this end, they learn the basics, which include, for example, system architectures, communication technologies and satellite-based positioning systems. The fundamentals taught are used in specific forms, applications and functions, which are then presented in two parts, divided into
1. Applications in road traffic and
2. Applications in rail transportation.

The road traffic applications taught in this course include navigation systems, digital systems for mobility management, the structure and functioning of so-called "Intelligent Transportation Systems" (ITS), such as V2X, and infotainment functions.

The following applications are presented in rail transportation: Basic functionalities of
the European Train Control System and, based on this, the
Automation levels GoA 1 to GoA 4 for the target operation of driverless, fully automated operation.
Operational and technical challenges and restrictions are explained using existing driverless track-guided systems, among other things.
The content taught is deepened and implemented in an application-oriented manner in a laboratory.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing this module, students understand the basic structure of digital and networked systems and applications in mobility. They will be able to participate in the design, development and expansion of corresponding systems. As a reference, they can draw on existing systems in road and rail transportation, which they have become familiar with in detail during the course.</td></tr>
</table>

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Janicki, Jürgen (2022): Systemwissen Eisenbahn, 3rd edition, Bahn Fachverlag, ISBN 978-3-943214- 30-7
- Hagemeyer, Friedrich; Preuß, Malte; Meyer zu Hörste, Michael; Meirich, Christian; Flamm, Leander (2021): Automated driving on the railways, 1st edition, Springer Vieweg Wiesbaden, ISBN 978-3- 658-32327-1
- Barbara Flügge: *Smart Mobility: Trends, concepts, best practices for intelligent mobility*. Sringer Vieweg, 2020.
- Heike Proff: *Transforming Mobility - What Next? Technical and business aspects*. Springer Gabler, 2022.
- Heike Proff: *New dimensions of mobility. Technical and business aspects*. Springer Gabler, 2020.
- Wolfgang Siebenpfeiffer: *Mobility of the future. Intermodal transportation concepts*. Springer Vieweg, 2021.

STS 22 Road traffic routes

<table>
<tr><td rowspan="4">No:
STS 22</td><td rowspan="3">Compulsory module:
Traffic routes Road</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination

form: KL60+PA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Traffic routes Road</td><td colspan="2">Prof. Dr. sc. ETH Gerko Santel</td><td>V+Ü</td><td>2+2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

This course deals with the fundamental principles and boundary conditions for road infrastructure. These include the structure, design and dimensioning of road traffic facilities. These are established on the basis of relevant guidelines and regulations of the Road and Transportation Research Association (FGSV).
The module focuses on the organization of the system of interurban roads and the structure and design of traffic networks outside and within towns (cf. RIN), the design of roads in the layout plan, elevation plan and cross-section (cf. RASt, RAL and RAA), the consideration of different junction forms as a basis for dimensioning (cf. HBS) and the dimensioning of junction-free road sections including facilities for pedestrian traffic, bicycle traffic and stationary traffic.
The exercises supplementing the lecture consolidate the knowledge imparted by means of typical questions from practice</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

Successful participation and cooperation will enable students to build on their basic knowledge to master the interrelationships, procedures and methods required for the technical design and/or operation of components or elements in the fields of road traffic engineering and road infrastructure.
They have a sound knowledge of road infrastructure. Technical terms and technical/operational contexts can be correctly classified and evaluated. Students will be able to apply relevant regulations correctly and effectively.</td></tr>
</table>

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Natzschka, H.: Straßenbau - Entwurf und Bautechnik; 3rd edition 2011; Teubner Verlag, Wiesbaden
- Velske S., H. Mentlein and P. Eymann: Straßenbautechnik; 7th edition 2013; Werner Verlag, Düsseldorf
- Schnabel W. and D. Lohse: Fundamentals of road traffic engineering and road traffic planning, Volume 1: Road traffic engineering; 3rd edition 2011; Beuth Verlag, Berlin/Kirschbaum Verlag, Bonn
- Road and Transportation Research Association (FGSV): Manual for the Design of Road Traffic Facilities (HBS); 2015 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for Integrated Network Design (RIN); 2008 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Motorways (RAA); 2008 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Rural Roads (RAL); 2012 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for the Design of Urban Roads (RASt); 2006 edition; FGSV-Verlag, Cologne

STS 23 Electromobility

<table>
<tr><td rowspan="4">No:
STS 23</td><td rowspan="3">Compulsory module:
Electromobility</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: KL
60+PA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h.</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">Events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">The basics of electromobility</td><td colspan="2" rowspan="2">Prof. Dr.-Ing. Marco Brey</td><td>V</td><td>2</td></tr>
<tr><td colspan="2">Current topics Electromobility</td><td>V+P</td><td>1+1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

In addition to the main drivers, the "Fundamentals of electromobility" section of this course presents the basic structures of electric vehicles, in particular the drive components, vehicle types and aspects of energy generation, distribution and storage. The wide range of applications in private and public transport, commercial vehicles, rail vehicles and watercraft will be considered. Current trends such as fuel cell battery vehicles on road and rail are also considered. Special aspects such as charging infrastructure and grid integration round off the topic area.
In the section "Current topics in electromobility", current developments in electromobility and special topics are to be dealt with in particular depth, and smaller projects are to be developed and presented by the students.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

The aim is to provide students with knowledge in the field of electromobility for various modes of transport and to gradually introduce them to the necessary basics and terminology. The main components of electrically powered vehicles and the most common designs are covered. Students will be sensitized to a holistic understanding of electromobility and will be able to demonstrate connections. After completing this course, students will have developed a sound understanding of the concepts of electromobility. The functionalities of the drive, storage, generation and distribution components with all essential boundary conditions are part of the acquired knowledge. They understand the relationships between energy supply, distribution and charging infrastructure and are familiar with possible business models and mobility concepts and can differentiate between them.
Students will be able to decide on possible applications in companies, justify them and help shape business models.</td></tr>
</table>

Literature and working materials

Own, updated extensive lecture materials (provided as PDF files) Kampker, Achim; Vallée, Dirk; Schnettler, Armin (eds.) (2018): Elektromobilität - Grundlagen einer Zukunftstechnologie, 2nd edition, Springer Vieweg, ISBN 978-3-662-53136-5
Ihme, J. (2016): Schienenfahrzeugtechnik, Wiesbaden, Springer Vieweg, ISBN 978-3-658-13540-9
Hilgers, M. (2023): Alternative Powertrain and Extensions to the Conventional Powertrain, 2nd Edition, Springer Vieweg, ISBN: 978-3-662-65570-2
Doppelbauer, M. (2020): Fundamentals of electromobility, Wiesbaden, Springer Vieweg, ISBN 978-3- 658-29729-9

STS 24 Compulsory elective module I

<table>
<tr><td rowspan="3">No:
STS 24</td><td rowspan="2">Compulsory elective module:
Elective subjects</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td>Prerequisites for participation: none</td><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination: see catalog WPF</td></tr>
<tr><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Compulsory elective subject A</td><td colspan="2">See catalog WPF</td><td>See catalog WPF</td><td>2</td></tr>
<tr><td colspan="2">Compulsory elective subject B</td><td colspan="2">See catalog WPF</td><td>See catalog WPF</td><td>2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: interdisciplinary</td></tr>
<tr><td colspan="6">Contents

See catalog WPF
Note: The scope of this compulsory elective module must total 4 SWS (= 6 credits). Either through 2 WPF with 2 SWS each or 1 WPF with 4 SWS.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

See catalog WPF</td></tr>
<tr><td colspan="6">Literature and working materials

See catalog WPF</td></tr>
</table>

STS 25 Student research project

<table>
<tr><td rowspan="4">No:
STS 25</td><td rowspan="3">Compulsory module:
Student research project</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination:
SA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
0 h</td><td>Self-study:
180 h.</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Student research project</td><td colspan="2">Supervising lecturer</td><td>B</td><td></td></tr>
<tr><td colspan="6">This module is used for the following degree programs: LOM, LOP, LIM, NaMo, STS</td></tr>
<tr><td colspan="6">Contents

The respective given problem/task, for which a written elaboration takes place. The student research project can be linked to the course of study in various ways. In addition, the task can also be based on the content of a course or on the evaluation of specialist literature</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

With their student research project, students work on a problem and a solution within a specified period of time.
/ The student is responsible for independently formulating a task from their subject area, which is formulated by a supervisor/examiner in consultation with the student. The previously learned principles of scientific work are thus put into practice for the first time, which also serves as preparation for writing the Bachelor's thesis.</td></tr>
<tr><td colspan="6">Literature and working materials

Course "Scientific work"
Faculty guidelines for the preparation of scientific papers.
The specific literature sources and working materials for the preparation of the thesis.</td></tr>
</table>

6. Module block

STS 26 Intelligent transportation technologies with laboratory

<table>
<tr><td rowspan="4">No:
STS 26</td><td rowspan="3">Compulsory module:
Intelligent transport technologies with laboratory</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: KL60+EA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Intelligent transportation technologies</td><td colspan="2" rowspan="3">Prof. Dr. sc. ETH Gerko Santel</td><td>V+Ü</td><td>1+1</td></tr>
<tr><td colspan="2">Traffic management laboratory, rail part</td><td>L</td><td>1</td></tr>
<tr><td colspan="2">Traffic management laboratory, road section</td><td>L</td><td>1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
<tr><td colspan="6">Contents

The course deals with definitions and concepts of traffic management, including new developments in the field of intelligent transportation systems. This includes telematics technologies as the basis of traffic management, integrated, intermodal traffic management as well as traffic and travel information systems. The tasks of traffic management in public transport and the functionalities of traffic management are also discussed. Various examples of traffic management facilities for different traffic systems and a discussion of how they work are used for this purpose. Project examples and, if possible, an excursion to a traffic management center are also an important part of the course.
In the laboratory, traffic management tools are used with the aid of relevant commercial software products. The results are interpreted and processed.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

After successfully completing this module, students will be familiar with the history of and reasons for traffic management as well as definitions of terms, objectives of traffic management, instruments of traffic management, parties involved in traffic management, components of traffic management and traffic management.
Online traffic management, opportunities and limits of traffic management, perspectives of traffic management.
Thanks to the associated laboratory, students are familiar with individual traffic management applications/tools. The topics covered will change.
After completing the module, students will be familiar with the main problems, scope for action, methods, procedures and instruments in the field of traffic management in different traffic systems. Students will be able to select the appropriate instruments, methods and measures for specific fields of application in terms of organizational, technical, operational, economic, ecological, etc. aspects. They will be able to</td></tr>
</table>

select appropriate instruments, methods and measures for the specific fields of application.

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Schnabel W. and D. Lohse: Fundamentals of road traffic engineering and road traffic planning, Volume 1: Road traffic engineering; 3rd edition 2011; Beuth Verlag, Berlin/Kirschbaum Verlag, Bonn
- Road and Transportation Research Association (FGSV): Manual for the Design of Road Traffic Facilities (HBS); 2015 edition; FGSV-Verlag, Cologne
- Road and Transportation Research Association (FGSV): Guidelines for traffic signal systems (RiLSA); 2010 edition; FGSV-Verlag, Cologne
- Documents from traffic management actors (traffic service providers) and centers, e.g. VMZ Berlin, VMZ Niedersachsen/Region Hannover, DB operations center, etc.
- Publications and conferences "Intelligent Transport Systems - ITS"

STS 27 Rail transport routes

<table>
<tr><td rowspan="4">No:
STS 27</td><td rowspan="3">Compulsory module:
Rail transport routes</td><td colspan="2">Language:
German</td><td colspan="2">Credits: 6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Examination form: KL
60+EA</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h.</td><td>Self-study:
120 h.</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Rail transport routes</td><td colspan="2">Prof. Dr.-Ing. Marco Brey</td><td>V+Ü</td><td>3+1</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: STS</td></tr>
</table>

Contents

This course deals with the essential basics and boundary conditions for the infrastructure of the rail mode of transport. The basics of wheel-rail contact, load transfer and track construction and the associated parameters (track classes) are covered, as well as energy supply in a national and international context. The characteristics and design features of different railroad systems (open track, stations), the main control and safety technologies and the interaction between vehicles and infrastructure are examined in detail in this module. Operational processes and methodical approaches for planning and optimizing the infrastructure round off the module topic. The exercise, which complements the lecture part, consolidates the knowledge imparted on the basis of typical questions from practice.

Learning objectives and skills to be taught

Upon successful completion of the course, students will have a sound knowledge of rail transport infrastructure. Technical terms and technical/operational correlations can be correctly classified and evaluated. In addition to the technical and operational basics, students will be able to calculate and assess design parameters and their effects. The compatibility of vehicles and infrastructure can be analyzed and evaluated in a differentiated manner and solutions can be developed and justified.

Literature and working materials

- Own, updated, comprehensive lecture materials (provided as PDF files)
- Lichtberger, Bernhard (2010): Handbuch Gleis: Unterbau - Oberbau - Instandhaltung - Wirtschaftlichkeit, 3rd edition, DVV Media Group GmbH Hamburg, ISBN 978-3-7771-0400-3
- Hausmann, Anita; Enders, Dirk H. (2017): Fundamentals of railroad operations, 3rd edition, Bahn Fachverlag, ISBN 978-3-943214-16-1
- Janicki, Jürgen (2022): Systemwissen Eisenbahn, 3rd edition, Bahn Fachverlag, ISBN 978-3- 943214-30-7
- Gert Heister/Jörg Kuhnke/Carsten Lindstedt/Roswitha Pomp/Thorsten Schaer/Thomas Schill/Stephan Schmidt/Norbert Wagner/Wolfgang Weber (2006): Railroad Operating Technology,
  1st edition, Bahn Fachverlag, ISBN 978-3-943214-35-2

STS 28 Case Studies

<table>
<tr><td rowspan="4">No:
STS 28</td><td rowspan="3">Compulsory elective module:
Case Studies</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
12</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td colspan="2">Workload:
360 h</td><td colspan="2" rowspan="2">Examination form:
see catalog Case Studies</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
120 h</td><td>Self-study:
240 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Case Study</td><td colspan="2">See catalog Case Studies</td><td>See catalog Case Studies</td><td>8</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: interdisciplinary</td></tr>
<tr><td colspan="6">Contents

- Topic-specific task processing in small groups
- Promotion of teamwork, conflict management
- Time management, self-management, project management
- Consolidation of scientific work through the preparation of a project report
- Get to know possible professional fields and practice partners
- Application and verification of theoretical knowledge in practice

Topics see catalog Case Studies</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

Students work independently on case studies and/or projects in areas relevant to the degree program. The aim of this course is to gain practical experience, deepen work in project groups, deal with problems, and work scientifically on a subject area. After successful participation, students have completed all phases of a project (planning, organization, implementation, monitoring) and complete it by preparing a comprehensive project report and, if applicable, a final project presentation for the project partner or lecturers.</td></tr>
<tr><td colspan="6">Literature and working materials

See catalog Case Studies</td></tr>
</table>

STS 29 Compulsory elective module II

<table>
<tr><td rowspan="4">No:
STS 29</td><td rowspan="3">Compulsory elective module:
Elective subjects</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
6</td></tr>
<tr><td colspan="2">Frequency:
annually in the summer semester</td><td colspan="2">Semester position: 5 or 6</td></tr>
<tr><td colspan="2">Workload:
180 h</td><td colspan="2" rowspan="2">Form of examination: see catalog WPF</td></tr>
<tr><td>Prerequisites for participation: none</td><td>Presence:
60 h</td><td>Self-study:
120 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (SWS)</td></tr>
<tr><td colspan="2">Elective subject C</td><td colspan="2">See catalog WPF</td><td>See catalog WPF</td><td>2</td></tr>
<tr><td colspan="2">Compulsory elective subject D</td><td colspan="2">See catalog WPF</td><td>See catalog WPF</td><td>2</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: interdisciplinary</td></tr>
<tr><td colspan="6">Contents

See catalog WPF
Note: The scope of this compulsory elective module must total 4 SWS (= 6 credits). Either through 2 WPF with 2 SWS each or 1 WPF with 4 SWS.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

See catalog WPF</td></tr>
<tr><td colspan="6">Literature and working materials

See catalog WPF</td></tr>
</table>

7. Module block

STS 30 Supervised practical phase

<table>
<tr><td rowspan="4">No:
STS 30</td><td rowspan="3">Compulsory module:
Supervised practical phase</td><td colspan="2">Language:
German</td><td>Credits:
15</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td>Semester position: 7</td></tr>
<tr><td colspan="2">Workload:
450 h</td><td rowspan="2">Examination form:
-</td></tr>
<tr><td>Prerequisites for participation: see examination regulations</td><td>Presence:
0 hrs.</td><td>Self-study:
450 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (CP)</td></tr>
<tr><td colspan="2">Supervised practical phase</td><td colspan="2">Supervising lecturer</td><td>B</td><td>15</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: LOM, LOP, LIM, LIP, NaMo and STS</td></tr>
<tr><td colspan="6">Contents

<u>Supervised practical phase:</u>
The practical semesters are generally designed in such a way that the students work on a project in the practical placement or are given a self-contained sub-project within this framework. In addition to the general orientation in the company/practical placement or the establishment of a working environment, the students spend the first part of the practical semester familiarizing themselves with the work. As a rule, the actual topic for the Bachelor's thesis is derived from the problem/task set by the practical placement in consultation with the university supervisor.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

<u>Supervised practical phase:</u>
In the practical phase, students should learn how to integrate themselves into the usual work processes in a company. In doing so, they should apply the knowledge they have acquired during their studies to practical methods</td></tr>
<tr><td colspan="6">Literature and working materials

none</td></tr>
</table>

STS 31 Bachelor thesis with colloquium

<table>
<tr><td rowspan="3">No:
STS 31</td><td rowspan="2">Compulsory module: Bachelor thesis and colloquium</td><td colspan="2">Language:
German</td><td colspan="2">Credits:
15</td></tr>
<tr><td colspan="2">Frequency:
annually in winter semester</td><td colspan="2">Semester position: 7</td></tr>
<tr><td colspan="2">Workload:
450 h</td><td colspan="2" rowspan="2">Examination form: BA+KO</td></tr>
<tr><td>Prerequisites for participation: see examination regulations</td><td>Presence:
0 h</td><td>Self-study:
450 h</td></tr>
<tr><td colspan="2">events</td><td colspan="2">Person responsible for the module</td><td>Teaching and learning methods</td><td>Scope (CP)</td></tr>
<tr><td colspan="2">Bachelor thesis</td><td colspan="2" rowspan="2">Supervising lecturer</td><td rowspan="2">B</td><td rowspan="2">15</td></tr>
<tr><td colspan="2">Colloquium</td></tr>
<tr><td colspan="6">This module is used for the following degree programs: LOM, LOP, LIM, LIP, NaMo and STS</td></tr>
<tr><td colspan="6">Contents

After the official issue of the topic by the examination board, the actual preparation of the Bachelor's thesis is a continuous process, which is usually started during the practical semester (in the last third) and intensified after completion. Supervision of the practical semester and supervision of the Bachelor's thesis are carried out by the same supervisor.

In the colloquium, the student provides a summary of their Bachelor's thesis. In a short presentation, the student presents the results of the Bachelor's thesis. The examiners ask questions about the content of the thesis.</td></tr>
<tr><td colspan="6">Learning objectives and skills to be taught

With their Bachelor's thesis, students demonstrate that they are able to independently work on a problem/task from their subject area, which is formulated by a supervisor/first examiner in consultation with the student, using scientific methods within a specified period of time. The exact procedure for this is regulated by the examination regulations. By preparing a presentation for the colloquium, students demonstrate that they are able to summarize and abstract the content of an academic paper in their Bachelor's thesis.</td></tr>
<tr><td colspan="6">Literature and working materials

The relevant literature sources and working materials.</td></tr>
</table>