



Module Handbook for Exchange Students

Summer Semester 2026

Please read the information before setting up your learning agreement.

1. Our Master courses **are not open for Bachelor students**, and we cannot make any exceptions.

2. The German half level course German A1.1 is recommended for exchange students. Intensive courses are not open to exchange students.

If you are an advanced student, please, use this link to find out what course level suits you best:

[Language proficiency test](#)

3. The **admission requirement** is a mandatory part of some courses (e.g., practical course). Students can only qualify for the exam if they have successfully completed the admission requirement. Successfully completed means that **all** the different parts of the admission requirement must be passed. Please check if the course requires an admission requirement and make sure that you will check this again with the lecturer during your first weeks into the semester.

4. Courses which are not listed in the exchange student's module handbook are not open for exchange students. Please do not contact us, the faculty, or the lecturer, to ask for permission! Again: no exceptions are made.

5. Faculty Mechanical Engineering:

Only winter semester: The course „**Energy from Biomass and Biogenic Residues**“ is taught in German but Prof. Goldbrunner answers questions in English and calculates in German and English. The exam contains a lot of calculations.

This module handbook is subject to change.

During the Orientation Week our International Office will help you with the course registration.



[Faculty of Mechanical Engineering](#)

[Faculty Engineering and Management](#)

[Faculty of Electrical Engineering and Information Technology](#)

[Faculty of Computer Science](#)

[Faculty of Business School](#)

[Language Center](#)



Course Descriptions

Mechanical Engineering

International Office

Summer term 2026

As per: 2026-02-03

This program and course description becomes effective on 15.03.2026. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations.

Energy Systems and Renewable Energies

Subject	SWS	ECTS
Building Energy Technology and Smart Homes	4	5
Control Engineering	5	5
Cost and Investment Management	4	5
Energy Distribution and CHP Plants	4	5
Energy Markets and Coupling Sectors	5	5
Energy Storage	4	5
Entrepreneurship and Sustainability	5	5
Material Science	4	5
Mechanics of Materials	4	5
Smart Grids and Wind Energy	4	5
Solar Buildings and Energy Consulting	4	5
Solar Energy Technologies	5	5
Solar Energy Technologies (admission requirement)	2	0
Thermodynamics 1	4	5

Building Energy Technology and Smart Homes	
Module abbreviation:	BETSH_ESYS
Curriculum:	Programmes
	Biomechanik Bachelor (BIO-B) - SPO-Nr.: 30 Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 27
Responsible for module:	Schrag, Tobias
Lecturers:	Akbar, Shariq; Reum, Tobias
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	30: Building Energy Technology and Smart Homes
Lecture types:	30: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
30: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • know different building envelope constructions and can calculate their thermal qualities. • know the energy balance of a building and understand the underlying building physics principles. • know the of relevance and influences of thermal comfort. • know about supply and distribution of thermal energy in buildings. • know the available systems and components for thermal energy supply by fossil and renewable sources. • know about thermal energy storage in buildings. • know about principles, constraints and planning of heat pumps. • know devices for heat transfer in buildings and can dimension them. • know the basics of ventilation systems. • know energy standards in new and existing buildings. • know how to calculate the size of a thermal energy supply system. • can compare Smart Homes to traditional control concepts. 	
Content:	
<p>Constraints about buildings</p> <ul style="list-style-type: none"> • overview of building types and energy consumption in buildings • heat consumption for warm water and heating • thermal comfort: influences from inside and outside, calculation mechanism • Overview of building energy law and building energy certificates • basic about ventilation systems • heat supply systems and their dimensioning 	

- plant- and system technique natural gas and oil boilers
- plant- and system technique gas and el. heat pumps
- plant- and system technique wood pellet boilers
- plant- and system technique wood chip boilers
- system technique district heating systems
- Radiators
- floor heating systems
- Basic HVAC Design
- Smart Home /building information systems
- Actors und sensors in buildings

Literature:

- HENS, Hugo, 2024. *Building physics - heat, air and moisture: fundamentals, engineering methods, material properties and exercises*. Berlin, Germany: Ernst & Sohn. ISBN 978-3-433-03422-4, 3-433-03422-2
- AGARWAL, Parul, MITTAL, Mamta, AHMED, Jawed, IDREES, Sheikh Mohammad, 2022. *Smart Technologies for Energy and Environmental Sustainability* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-030-80702-3. Available via: <https://doi.org/10.1007/978-3-030-80702-3>.
- KHAZAILI, Javad, 2014. *Energy-efficient HVAC design: an essential guide for sustainable building* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-319-11047-9, 978-3-319-11046-2. Available via: <https://doi.org/10.1007/978-3-319-11047-9>.
- JAIN, Arpit, SHARMA, Abhinav, JATELY, Vibhu, AZZOPARDI, Brian, 2024. *Sustainable energy solutions with artificial intelligence, blockchain technology, and internet of things* [online]. Boca Raton: CRC Press PDF e-Book. ISBN 978-1-003-35663-9. Available via: <https://doi.org/10.1201/9781003356639>.
- MORENO-MUÑOZ, Antonio and Neomar GIACOMINI, 2023. *Energy smart appliances: applications, methodologies, and challenges*. Piscataway, NJ: IEEE Press. ISBN 978-1-119-89945-7, 9781119899440

Control Engineering	
Module abbreviation:	ContrEng_ESYS
Curriculum:	Programmes
	Biomechanik Bachelor (BIO-B) - SPO-Nr.: 30 Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 23
Responsible for module:	Navarro Gevers, Daniel
Lecturers:	Braun, Julian; Navarro Gevers, Daniel
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	30: Control Engineering
Lecture types:	30: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
30: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • know the basic concepts of control engineering. • know the descriptions of linear control elements (dgl. and transfer function). • model simple systems. • know the behaviour of common control elements. • understand the functioning of a control loop. • know common controller types and can adjust the controllers. • can design controllers in the frequency range and using root locus curves. • can design pilot controls. • can analyse the behaviour of non-linear control loops. 	
Content:	
<p>The control loop</p> <ul style="list-style-type: none"> • Detailed introductory example with simulation practical course • Linear control loop elements with simulation practical course • Stability • Laplace transformation • Frequency response • Control loop analysis • Controller design, also with Matlab (practical course) • Nonlinear control loops • rudiments of artificial intelligence 	

Literature:

- OGATA, Katsuhiko, 2010. *Modern control engineering*. Boston [u.a.]: Pearson. ISBN 978-0-13-713337-6, 0-13-713337-5
- NISE, Norman, . *Nise's control systems engineering* . ISBN 978-1-119-38297-3

Cost and Investment Management	
Module abbreviation:	CostInvManag_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 24
Responsible for module:	Weitz, Klaus Peter
Lecturers:	Busche, Annika
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	24: Cost and Investment Management
Lecture types:	SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
24: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> understand the fundamentals of cost management and cost control in an international and sustainability-oriented business environment. can read and interpret balance sheets, income statements, and cash flow statements of companies. understand the structure and tasks of internal accounting systems and how sustainability considerations can be integrated into managerial accounting. recognize their own responsibility in product development for product costs, life-cycle costs, and ESG performance along the value chain. recognize factors influencing product costs and methods for reducing costs. understand the necessities and challenges of investment decisions and assess the profitability of investments. identify challenges in integrating sustainability criteria into financial markets and corporate investment decisions and apply these insights to real investment projects. perform financial and non-financial calculations to support investment decisions that meet both economic and ESG requirements. 	
Content:	
<ul style="list-style-type: none"> Buyer and sales motivation, importance of customer value, and customer orientation External accounting: Balance sheet, profit and loss statement, cash flow statement, key performance indicator, including how ESG-related disclosures are reflected in corporate reporting Tasks of internal accounting and differences compared to external accounting Implementation of internal accounting, cost type, cost center and product cost accounting, including the integration of sustainability-driven cost factors (e.g., resource efficiency, carbon costs, circularity) Identifying challenges in integrating sustainability into financial markets and investment decisions and applying these insights to practical investment assessments 	

- Methods of calculating product costs, including the consideration of sustainability-related cost drivers (e.g., resource efficiency, energy use, material selection)
- Necessity of cost management, especially in balancing economic performance with ecological and social requirements
- Responsibility and influence of product development on product and life cycle costs.
- Methods of cost control in product development, integrating sustainability KPIs (e.g., CO₂ footprint, recyclability, durability)
- Methods of cost reduction in product development
- Influence of complexity and number of variants on product costs, including sustainability implications (e.g., resource use, waste, production efficiency), and related methods of sustainable cost reduction
- Investment management and investment processes, including sustainability as a strategic investment criterion
- Methods for investment calculation

Literature:

- EHRENSPIEL, Klaus, KIEWERT, Alfons, LINDEMANN, Udo, 2007. *Cost-Efficient design* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 3-540-34647-3, 978-3-540-34648-7. Available via: <https://doi.org/10.1007/978-3-540-34648-7>.
- SULLIVAN, William G., Elin M. WICKS and C. Patrick KOELLING, 2020. *Engineering economy*. New York, NY: Pearson. ISBN 978-1-292-26496-7
- Further literature will be announced in lecture.

Energy Distribution and CHP Plants	
Module abbreviation:	EnergDistCHPP_ESYS
Curriculum:	Programmes
	Biomechanik Bachelor (BIO-B) - SPO-Nr.: 30 Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 17
Responsible for module:	Denter, Niklas
Lecturers:	Denter, Niklas; Sander, Peter; Selleneit, Volker
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	30: Energy Distribution and CHP Plants
Lecture types:	30: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
30: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> gain extensive knowledge of CHP technology, its operation and economic influences, taking into account the relevant fuels. are able to evaluate CHP plants as energy centers at different locations. They know their economic influencing variables, as well as the allocation methods to evaluate the CO2 reduction. learn about CHP technology as a plannable and flexible energy supply technology. have an overview of the possibilities to distribute heat and cold. they deal in depth with the topic of heat networks and are able to design them. gain knowledge about hydrogen as an energy carrier. know the interactions between the different heat sources and the heat network (temperature levels) and their effect on operating costs as well as energy losses. get an introduction into sector coupling energy system planning. 	
Content:	
<p>CHP (electricity and heat supply by means of gas-fired CHP):</p> <ul style="list-style-type: none"> CHP technology Efficiencies, influencing factors, utilization rates, efficiency CO2 reduction, allocation methods for CO2 reduction evaluation Cost structure: heat supply costs, electricity supply costs Operating modes: historical, current and future Efficient integration of CHP (heat and power) into the energy system Permitting aspects (exhaust emissions, installation site, noise) Legal framework for CHP operation 	

- Design of future sites
- "Green" hydrogen as an energy carrier

Heat distribution (deeper insight into energy distribution by means of heat network):

- Heat sinks (demand profiles)
- Losses
- Flow/return temperature
- Heat storage, hydraulic separator
- Transfer systems
- Influencing variables
- Cold networks and heat pumps
- Integration of solar thermal energy into heating networks
- Large solar thermal fields
- Heat storage especially in connection with solar thermal energy
- Economic efficiency of solar thermal energy

Basics of gas networks (energy distribution by means of gas network):

- pipeline-based energy transport (transport capacity, capacity price, working prices)
- Basics and basic terms (gaseous transport)
- gas quality (natural gas, hydrogen, biomethane, e-gas)
- Structure and components of a gas pipeline
- Transport network in Europe / Germany
- DVGW regulations

Basics of electricity grids (regulatory and energy industry):

- Historical development
- Electricity distribution structures
- Technical overview (voltage levels, tasks, responsibilities, structures)
- European / German power grid
- Current developments (network development plan, etc.)

Literature:

- SCHMIDT, Dietrich, 2023. *Guidebook for the digitalisation of district heating: transforming heat networks for a sustainable future: final report ; Annex TS4, Digitalisation of district heating, optimised operation and maintenance of district heating and cooling systems via Digital Process Management*. Frankfurt am Main: AGFW-Project Company. ISBN 3-89999-096-X
- BREEZE, Paul, 2018. *Combined heat and power*. London ; San Diego ; Cambridge, MA ; Kidlington, Oxford: Elsevier. ISBN 978-0-12-812908-1, 0128129085
- FREDERIKSEN, Svend and Sven WERNER, 2013. *District heating and cooling*. Lund: Studentlitteratur. ISBN 978-91-44-08530-2
- HORLOCK, . *Cogeneration-combined heat and power (CHP) : thermodynamics and economics*.
- HORLACHER, HELBIG and AIGNER , . *Hydro- und Gasdynamik*.
- KERSTING, William H., 2002. *Distribution system modeling and analysis*. Boca Raton [u.a.]: CRC Press. ISBN 0-8493-0812-7
- GÖNEN, Turan, Chee-Wooi TEN and Ali MEHRIZI-SANI, 2024. *Electric power distribution engineering*. Boca Raton: CRC Press. ISBN 978-0-367-65495-5, 978-0-367-65499-3
- Further literature will be announced in lecture.

Energy Markets and Coupling Sectors	
Module abbreviation:	EngMaCS_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 28 Maschinenbau Bachelor (MB-B) - SPO-Nr.: 26
Responsible for module:	Huber, Matthias
Lecturers:	Chu, Jiahe; Huber, Matthias; Mokeke, Sebota
Language of instruction:	English
Credit points / SWS:	5 ECTS / 5 SWS
Workload:	Contact hours: 58 h
	Self-study: 67 h
	Total: 125 h
Subjects of the module:	28: Energy Markets and Coupling Sectors
Lecture types:	28: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
28: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
Basic knowledge of energy economics Basic knowledge of energy production Basic knowledge of business administration Combination with other lectures/topics Builds on and deepens other lectures: Energy Distribution and CHP SmartGrids and Wind Energy Energy economics and renewable energies	
Objectives:	
The students <ul style="list-style-type: none"> • understand the individual energy markets and the interactions through sector coupling. • know the influence of the power grids and system security requirements. • have an overview of the technologies that are relevant for sector coupling and know their economic opportunities. • will be able to evaluate individual technologies from an economic and technical point of view and with regard to their environmental impact, and will be familiar with the factors that influence economically successful operation. • will be able to formulate, analyze and solve linear programming problems both analytically and using computational tools. 	
Content:	
Energy markets and regulatory framework: <ul style="list-style-type: none"> • Fundamentals of markets, supply and demand curves, pricing • Levelized Costs of Electricity 	

- How does the electricity market work, electricity prices
 - Electricity exchange, energy only markets
 - Influence of renewable energies, funding schemes
 - Influence of power grid and system security
 - Interaction with neighbouring countries
 - Electricity demand, electricity generation
- The heat market, heat prices, developments, influences
 - Heat demand
 - Heat generation
- The gas market, gas prices, developments, influences
- System services Electricity grid operation
- Fuel markets
- New markets: local electricity markets, hydrogen market in the mobility sector

Power System Operation Basics

- Power system structure
- Load flow
- Power system stability
 - Voltage
 - Frequency
 - Rotor
- Operational issues
 - Balancing-Frequency control and support
 - Power transfer limits
 - Voltage Control and support
 - System Restoration
 - Reliability resources
 - Stability Services

Secure electricity transport in the public grid as an additional market:

- Generation structures (effect of RES generation, flexibility of power plants, profile electricity generation with renewables).
- Power distribution structures
- Measures for system security
 - System services (control power, reactive power, islanding and black start capability)
 - Capacity reserves, cold reserves
 - Disconnectable loads
 - Feed-in management
 - Smart markets

Renewable Support Schemes

Overview of sector coupling technologies

- Definition and Background
- Why sector coupling
- Benefits
- Storage
- Batteries in electric vehicles
- Heat pump
- Power to Heat
- Power to Gas (methane, hydrogen)
- Power to Liquid
- CHP
- Energy hubs

- Smart Home (as controllable load)
- Industrial processes (system efficiency)
- Electric cars

The individual technologies are evaluated according to their technical characteristics:

- Responsiveness
- Energy to power ratio (full load hours, utilization capability)
- Demand response capability

Introduction to linear programming:

- Fundamentals of optimization
 - Types of optimization problems
 - Objective functions
 - Constraints
 - Decision variables
 - Parameters
- Mathematical formulation of linear programming problems
- Manual mathematical solution of basic linear programming problems
- Application of linear programming to solve a dispatch problem using Pyomo

Literature:

- STOFT, Steven, 2010. *Power system economics: designing markets for electricity*. Piscataway, NJ: IEEE Press. ISBN 0-471-15040-1, 978-0-471-15040-4
- BRADFORD, Travis, 2018. *The energy system: technology, economics, markets, and policy*. Cambridge, MA: The MIT Press. ISBN 978-0-262-03752-5
- BHATTACHARYYA, Subhes C., 2019. *Energy economics: concepts, issues, markets and governance* [online]. London: Springer PDF e-Book. ISBN 978-1-4471-7468-4. Available via: <https://doi.org/10.1007/978-1-4471-7468-4>.
- Will be announced in lecture

Energy Storage	
Module abbreviation:	EnergStor_ESYS
Curriculum:	Programmes
	Biomechanik Bachelor (BIO-B) - SPO-Nr.: 30 Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 11
Responsible for module:	Reum, Tobias
Lecturers:	Reum, Tobias; Schmitt, David
Language of instruction:	German
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	30: Energy Storage
Lecture types:	30: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
30: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • can judge the need of storage according to the energy economic situation. • can differentiate between base load and peak load storage. • can evaluate different storages technologies according to a variety of criteria. • can estimate the economic benefit of a storage system. • can dimensionate storage systems. 	
Content:	
<ul style="list-style-type: none"> • storage properties • energy density • storage cycles • charging speed • thermal energy storage • hot tap water storages • heating storage • steam storage • latent heat storage • chemical storage • dimensioning of storages • electrical energy storages: <ul style="list-style-type: none"> • battery basics • charge control • central vs decentral 	

- chemical storages
- gas storage hydrogen storage conversion efficiencies
- types of hydrogen storages
- mechanical storages
- pumped hydro
- compressed air storage

Literature:

- MATHEW, V. K., HOTTA, Tapano Kumar, ALI, Hafiz Muhammad, SUNDARAM, Senthilarasu, 2023. *Energy Storage Systems: Optimization and Applications* [online]. Singapore: Springer Nature Singapore PDF e-Book. ISBN 978-981-1945-02-1. Available via: <https://doi.org/10.1007/978-981-19-4502-1>.
- GUDE, Veera Ganeswar, 2023. *Energy storage for multigeneration: desalination, power, cooling and heating applications*. London: Elsevier. ISBN 978-0-12-821921-8
- NAMRATA, Kumari, SAINI, R. P., KOTHARI, D. P., 2024. *Wind and Solar Energy Systems* [online]. Singapore: Springer Nature Singapore PDF e-Book. ISBN 978-981-9997-10-7. Available via: <https://doi.org/10.1007/978-981-99-9710-7>.
- BRUN, Klaus, Timothy ALLISON and Richard DENNIS, 2021. *Thermal, mechanical, and hybrid chemical energy storage systems*. London, United Kingdom ; San Diego, CA, United States ; Cambridge, MA, United States ; Kidlington, Oxford, United Kingdom: Academic Press, an imprint of Elsevier. ISBN 978-0-12-819894-0

Entrepreneurship and Sustainability	
Module abbreviation:	EntrSus_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 12
Responsible for module:	Lange, Marlene
Lecturers:	Rafique, Amber; Ramakrishna Babu Jai, Ganesh
Language of instruction:	English
Credit points / SWS:	5 ECTS / 5 SWS
Workload:	Contact hours: 58 h
	Self-study: 67 h
	Total: 125 h
Subjects of the module:	12: Entrepreneurship and Sustainability
Lecture types:	12: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
12: LN - StA+Coll. (student research project with colloquium), written 8-15 pages or presentation 15-20 pages; oral exam 10-15 min. Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • have acquired basic knowledge in the areas of sustainability, sustainable development and sustainability management. • have acquired an understanding of the main global challenges (such as climate change, resource scarcity) and understand the interactions between the dimensions of economy, ecology and social issues. • understand what entrepreneurship means and which specific challenges are important for the start-ups. • are familiar with the basic concepts and methods of innovation management. • are able to transfer the principle of sustainability to their study contents. • are able to link innovation and sustainability. • are able to develop a business idea under consideration of sustainability criteria, to elaborate and present in a business plan. • are able to apply agile innovation and product development methods and tools. • are able to discuss and present results competently. • understand the interaction of different disciplines. • possess methodological and social skills in areas such as teamwork, communication skills, creative techniques, project management and time management. 	
Content:	
<p>Introduction: Understanding sustainability and sustainable development</p> <ul style="list-style-type: none"> • Fundamentals of sustainability and sustainable development • Global challenges and risk posed by non-sustainability • Opportunities of sustainable development • Sustainability as a driver innovation 	

- Sustainable production and consumption

Theory of entrepreneurship

- What does "entrepreneurship" mean?
- Business models and the business model canvas
- Strategy, product development and marketing of start-ups
- Financing and selection of investors
- Contents of business plans

Theory of innovation management

- Definition and goals of innovation
- Types of innovations
- Sources/search fields for innovations
- Innovation strategy

Exercise Design Thinking: Sustainable Innovation and Business Model (development of a sustainable and feasible business idea in teamwork)

Literature:

- SINEK, Simon, 2019. *Start with why: how great leaders inspire everyone to take action*. [London]: Penguin Business. ISBN 978-0-241-95822-3
- RIES, Eric, 2017. *The lean startup: how today's entrepreneurs use continuous innovation to create radically successful businesses*. New York: Currency. ISBN 978-1-5247-6240-7
- TIDD, Joseph and John R. BESSANT, 2021. *Managing innovation: integrating technological, market and organizational change*. Hoboken, NJ: Wiley. ISBN 978-1-119-71330-2

Material Science	
Module abbreviation:	MatSc_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 4
Responsible for module:	Oberhauser, Simon
Lecturers:	Oberhauser, Simon
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	4: Material Science
Lecture types:	SU/Ü/Pr - seminar based teaching/exercise course/laboratory
Studien- / Prüfungsleistungen:	
4: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • know the different types of chemical bonds and their occurrence in materials. • are familiar with the most common metallic lattice structures and know the influence of these structural types on plastic formability. • are able to denominate and sketch structural disorders and to explain the role of dislocations during plastic deformation. • understand the context between different hardening mechanisms of metals and the kinds of disorder, responsible for the considered hardening effect. • can explain the mechanisms of diffusion in solids, know the time and temperature dependence of diffusion processes and selected technical procedures, where diffusion plays an important role. • are familiar with the basic types of phase diagrams in general and are able to interpret the phase diagram Iron Carbon in particular. • understand how solidification processes are influenced by nucleation and crystal growth and therefore, how the microstructure and properties of cast parts can be controlled. • know the fundamentals of the kinetics of solid-state reactions and understand the mechanism, course and result of martensitic transformation and precipitation reactions as well. • know typical methods of material testing and characterization. 	
Content:	
<ul style="list-style-type: none"> • Atomic structure and the nature of chemical bonding • Structures of solids, especially metals • Imperfections in real crystals • Plastic deformation in ideal and real crystals, hardening effects by disorders • Diffusion – mechanism, meaning and applications • Phases and phase diagrams 	

- Kinetics of solidification
- Kinetics of solid state reactions – martensitic transformation and precipitation reactions (hardening of metallic materials)
- Materials testing and material characterization

Literature:

- ASKELAND, Donald R. and others, 2022. *The science and engineering of materials*. Boston, MA: Cengage. ISBN 978-0-357-44786-4, 978-0-357-44788-8
- CALLISTER, William D. and David G. RETHWISCH, 2020. *Materials science and engineering: an introduction*. 10. edition. Hoboken, NJ: Wiley. ISBN 978-1-119-45391-8

Mechanics of Materials	
Module abbreviation:	MechMat_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 8
Responsible for module:	Dallner, Rudolf
Lecturers:	Burger, Uli
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	8: Mechanics of Materials
Lecture types:	SU/Ü - Seminar-based teaching with exercises
Studien- / Prüfungsleistungen:	
8: schrP90 - written exam, 90 minutes	
Additional Explanation:	
None	
Recommended prerequisites:	
successful participation in the module statics	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • are able to analyze and evaluate the stresses on machine parts and structures under static mechanical loads and to dimension these components. • are able to calculate stresses and strains resp. deformations that occur in components as a result of loads such as tension/compression, bending, torsion or combined loading and evaluate them using strength hypotheses. • can calculate deformations on beam-like components for statically determinate and indeterminate systems. • understand the concept of stress tensor and can perform coordinate transformations and calculate principal stresses. • can evaluate multiaxial stress states using equivalent stresses. • are able to analyze columns under buckling. • are familiar with the concept of stress concentration problems. • are familiar with the basic concepts of elastostatics and are able to express themselves competently in the field of mechanics of material. • are able to discuss and explain calculated results in a professional manner. • are able to apply mathematical principles to calculations with confidence. • have a capacity for abstraction and can solve tasks independently and in a team in a structured manner. 	
Content:	
<ul style="list-style-type: none"> • Introduction to the basic concepts of mechanics of materials like stress and strain, Hooke's law and tension-compression as well as thermal expansion and thermal stresses • Multiaxial stress states, transformation relations, stress tensor, principal stresses; Mohr's circle • Linear elastic constitutive law for plane stress conditions and in the three-dimensional case • Moments of inertia 	

- different types of loading, such as tension-compression, bending, torsion and the resulting stresses and deformations
- Deflections of beams under statically determinate and indeterminate conditions
- Combined loading and resulting stresses and deformations
- Equivalent stresses and stress evaluation, strength verification
- stress concentration problems
- Buckling of columns
- Extensive exercise examples of practical engineering applications according to the course of study

Literature:

- HIBBELER, Russell C. and Jun Hwa LEE, 2024. *Statics and mechanics of materials*. Harlow: Pearson. ISBN 978-1-292-46020-8, 1-292-46020-2
- GROSS, Dietmar, GROSS, Dietmar, HAUGER, Werner, SCHRÖDER, Jörg, WALL, Wolfgang A., BONET, Javier, Band 2[2018. *Engineering mechanics* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-3-662-56272-7. Available via: <https://doi.org/10.1007/978-3-662-56272-7>.
- GOMERINGER, Roland and others, 2018. *Mechanical and Metal Trades Handbook*. Haan-Gruiten: Verlag Europa-Lehrmittel, Nourney, Vollmer GmbH & Co. KG. ISBN 978-3-8085-1915-8, 3-8085-1915-0

Smart Grids and Wind Energy	
Module abbreviation:	SmGrWiEnerg_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 18 Maschinenbau Bachelor (MB-B) - SPO-Nr.: 26
Responsible for module:	Navarro Gevers, Daniel
Lecturers:	Navarro Gevers, Daniel; Scherer Farina, Anneliese
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	18: Smart Grids and Wind Energy
Lecture types:	18: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
18: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • know the function of the most important network operating resources in the power grid. The functionality and communicative networking and control of power generators, consumers and storage systems are known and can be described. • can differentiate between energy transmission networks and distribution networks and distinguish between their main tasks. • learn which intelligent solutions are available or possible in the future for the grid integration of renewable energy sources into the power grid. • can reproduce control structures such as load control, frequency control or voltage control. • will be able to analyze and understand wind data. They can assume a distribution and perform probability calculations. • can calculate the annual energy yield of a wind farm at a given location. • will be able to prepare a technical specification for a wind turbine. • will be able to select specific wind turbines on the market that meet the project specifications. 	
Content:	
<p>1. Network resources, generators and consumers:</p> <ul style="list-style-type: none"> • Generators/consumers • Transformers • Generators • Storage facilities • Smart metering, intelligent meters • Converter technology • Grid topologies 	

2. Grid stability strategies

- Grid integration, grid stability
- Forecasting methods
- Load control/load shifting

3. Energy systems of the future

- Smart grids

4. Wind Power

- Technical basics of a wind turbine
- Evaluating wind data
- Energy calculation
- Selection of a wind turbine
- Use of artificial intelligence in the maintenance strategy
- Rudiments of power electronics

Literature:

- HAU, Erich, 2013. *Wind turbines: fundamentals, technologies, application, economics ; 41 tables* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-3-642-27151-9. Available via: <https://doi.org/10.1007/978-3-642-27151-9>.
- REKIOUA, Djamilia, . *Wind Power Electric Systems : Modeling, Simulation, Control and Power Management Control* . ISBN 978-3-031-52883-5
- SGUAREZI, Alfeu and others, 2024. *Smart grids - renewable energy, power electronics, signal processing and communication systems applications*. Cham, Switzerland: Springer. ISBN 978-3-031-37908-6, 978-3-031-37911-6

Solar Buildings and Energy Consulting	
Module abbreviation:	SolBuEC_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 31
Responsible for module:	Schrag, Tobias
Lecturers:	Feuchter, Fabian; Schrag, Tobias
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	31: Solar Buildings and Energy Consulting
Lecture types:	31: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
31: mdIP - oral exam, 15 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • know different building concepts like passive houses, solar active houses or plus energy houses. • can apply the rules of energetic refurbishment and energy consulting. • learn the calculation of the heat energy demand, end energy and primary energy consumption according to DIN18599. • analyse the thermal weaknesses of a building and define an individual refurbishment concept. • know about building simulation through practical experience. • can use KPIs for evaluation autonomy and economy of building related PV installations. • know about energy plus district concepts and the integration of advanced technologies like PVT, ice storages or dual source heat pumps. • know the differences of energy concepts for residential and non-residential buildings and know about HVAC concepts for office buildings. 	
Content:	
<ul style="list-style-type: none"> • application of the German building energy law • heat bridges in new and existing buildings • deficits and inefficiencies of heating systems • energy certificates • low investment refurbishment measures • comparison of calculated and measured heat energy consumption • ventilation concepts • investment calculation according to VDI 2067 	

Literature:

- BEAUSOLEIL-MORRISON, Ian, 2021. *Fundamentals of building performance simulation*. New York ; London: Routledge. ISBN 978-1-00-016928-7, 978-1-003-05527-3
- HACHEM-VERMETTE, Caroline, 2020. *Solar buildings and neighborhoods: design considerations for high energy performance*. Cham, Switzerland: Springer. ISBN 978-3-030-47018-0
- YUDELSON, Jerry, 2009. *Green building trends: Europe*. Washington, DC: Island Press. ISBN 978-1-61091-134-4, 1-61091-134-2
- EICKER, Ursula, 2014. *Energy efficient buildings with solar and geothermal resources*. Chichester, West Sussex, United Kingdom: John Wiley & Sons Inc.. ISBN 978-1-118-35224-3, 978-1-118-70707-4

Solar Energy Technologies (with practical course)	
Module abbreviation:	SoIET_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 19
Responsible for module:	Weitz, Klaus Peter
Lecturers:	Trinkl, Christoph; Weitz, Klaus Peter (SoIET_ESYS) Trinkl, Christoph; Weitz, Klaus Peter (SoIETAR_ESYS)
Language of instruction:	English
Credit points / SWS:	5 ECTS / 5 SWS
Workload:	Contact hours: 58 h
	Self-study: 67 h
	Total: 125 h
Subjects of the module:	19: Solar Energy Technologies 19.1: Solar Energy Technologies (admission requirement)
Lecture types:	19: SU/Ü/PR - seminar based teaching/Exercise course/laboratory 19.1: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
19: schrP90 - written exam, 90 minutes 19.1: LN - prA - participation with/without success Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • have a theoretical and practical understanding of the direct use of the sun as an energy source. • have an overview of the status and framework conditions of solar heat utilisation as well as the potentials, possible applications and challenges. • understand the generation of solar heat in small and large solar systems for different applications. • are familiar with the components and system configurations of solar useful heat generation. • understand design methods and tools and are able to use them in project planning. • are able to simulate a solar thermal system and carry out an ecological and economic evaluation. • know and understand the development of photovoltaics in recent years, they can interpret and classify the current status. • understand the different components, the physical principles, the manufacturing processes and the functioning of solar cells and photovoltaic systems. • can design and plan photovoltaic systems. • understand the integration of photovoltaic systems into the building technology and can simulate self-consumption and self-production of electricity. <p>The students</p> <ul style="list-style-type: none"> • understand functionalities and energy flows in solar thermal systems. • can evaluate the efficiency and practical behaviour of solar thermal systems. • understand solar collector efficiency testing procedures. • can evaluate collector efficiency under different operational conditions. 	

- have a thorough understanding of functionalities, characteristics, potentials and limitations of different testing facilities for solar collectors and systems.

Content:

- Basics of solar energy:
 - Solar energy resources, solar irradiation on earth, calculation of the position of the sun, solar irradiation on inclined planes, shading, measurement methods.
- Solar thermal energy in the energy mix of the future
 - Use of solar thermal energy globally, at European and national level, perspectives of solar thermal energy in the energy mix
- Solar thermal systems (incl. laboratory course)
 - System variants and components for solar thermal domestic hot water, space heating, thermosiphon and solar air systems, design and operational strategies of solar thermal systems, solar yield and costs, area of application, design, and special features of large solar systems.
- Solar thermal collectors (incl. laboratory course)
 - Conversion of solar radiation into heat, efficiency of thermal collectors, collector types, design, installation, and operation of collector arrays.
- Modelling and simulation of solar thermal systems (incl. simulation workshop)
 - Opportunities and limitations of solar system simulation, areas of application and available software, modelling, parameter definition, simulation and results interpretation by means of application examples in the Polysun software suite.
- Photovoltaic
 - Development of photovoltaics in Germany and the world, the German Renewable Energy Act and the photovoltaic market.
 - Function and manufacturing process of a solar cell.
 - Functionality and tasks of an inverter.
 - Planning of a photovoltaic system (roof layout, inverter design, statics, ...).
 - Installation, cleaning and maintenance of photovoltaic systems.
 - Self-consumption of electricity (consumption profile, supply profile, consumption adoption, battery storage).
 - Other forms of photovoltaic systems (tracking systems, off-grid systems, ground-mounted systems)
- Experimental analysis of functionalities and energetic performance of solar thermal systems: System components and their functionalities, energy flows, storage tank behaviour, collector efficiency
- Solar collector testing according to EN ISO 9806: Solar irradiance and collector optics, testing procedures and facilities, efficiency testing and evaluation

Literature:

- QUASCHNING, Volker, 2016. *Understanding renewable energy systems* [online]. London and New York: Routledge PDF e-Book. ISBN 978-1-315-76943-1, 978-1-317-66942-5. Available via: <https://doi.org/10.4324/9781315769431>.
- EICKER, Ursula, ©2003. *Solar technologies for buildings* [online]. Chichester: Wiley PDF e-Book. ISBN 978-1-60119-550-0, 1-60119-550-8. Available via: <https://onlinelibrary.wiley.com/doi/book/10.1002/0470868341>.
- DUFFIE, John A., BECKMAN, William A., 2013. *Solar engineering of thermal processes* [online]. Hoboken, NJ: Wiley PDF e-Book. ISBN 978-1-118-67160-3, 978-0-470-87366-3. Available via: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781118671603>.
- TIWARI, G. N., TIWARI, Arvind, SHYAM, 2016. *Handbook of Solar Energy: Theory, Analysis and Applications* [online]. Singapore: Springer Singapore PDF e-Book. ISBN 978-981-10-0807-8. Available via: <https://doi.org/10.1007/978-981-10-0807-8>.
- ALEXOPOULOS, Spiros, KALOGIROU, Soteris A., 2022. *Solar Thermal Energy* [online]. New York, NY: Springer US PDF e-Book. ISBN 978-1-07-161422-8. Available via: <https://doi.org/10.1007/978-1-0716-1422-8>.

Thermodynamics 1	
Module abbreviation:	TD1_ESYS
Curriculum:	Programmes
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 9
Responsible for module:	Goldbrunner, Markus
Lecturers:	Goldbrunner, Markus
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	9: Thermodynamics 1
Lecture types:	9: SU/Ü/PR - seminar based teaching/Exercise course/laboratory
Studien- / Prüfungsleistungen:	
9: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • know the properties of pure media (gases, liquids, homogenous mixtures) and the associated laws. • are able to graphically represent and calculate changes of state of the model fluids "ideal gas" and "incompressible liquid" depending on the process control. • are familiar with the laws of energy conversion (1st and 2nd law of thermodynamics). • are able to describe the course of a thermodynamic process on the basis of the state variable entropy and to determine the energetic conversion quality of real state changes. • can calculate and evaluate applied energetic single processes (compressor/turbine/heat exchanger). • know the thermodynamic cycle processes of working and power machines and can thus make basic statements on the operating behaviour of these machines. • are familiar with the basics of phase transformation in multiphase systems using water as an example. 	
Content:	
<ul style="list-style-type: none"> • Chapter 1: Fundamentals of Thermodynamics • Chapter 2: Exchange and conservation of energy (1st law of thermodynamics) • Chapter 3: Exchange and generation of entropy (2nd law of thermodynamics) • Chapter 4: Changes of state of model fluids 	
Literature:	
<ul style="list-style-type: none"> • WHITMAN, Alan M., 2023. <i>Thermodynamics: Basic Principles and Engineering Applications</i>. Cham: Springer International Publishing. ISBN 978-3-031-19538-9 • ÇENGEL, Yunus A., Michael A. BOLES and Mehmet KANOĞLU, 2024. <i>Thermodynamics: an engineering approach</i>. New York, NY: McGraw Hill. ISBN 978-1-266-15211-5, 1-266-15211-3 • PAUKEN, Michael, 2011. <i>Thermodynamics for dummies</i>. Hoboken, NJ: Wiley. ISBN 978-1-118-12098-9, 978-1-118-12100-9 	

- Will be announced in the lecture



Course Descriptions

Engineering and Management

International Office

Summer term 2026

As per: 2026-02-03

This program and course description becomes effective on 15.03.2026. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations

Engineering and Management (EGM)

Subject	SWS	ECTS
R&D-/Technology Management	4	5
Controlling	4	5
Electrical Engineering	5	5
Financial Accounting	5	5
Mathematics 2	5	5
Mechanical Design 1	4	5
Power Engineering	4	5
Production Planning and Logistics	4	5
Production systems	4	5

Engineering and Management (EGM) - Master

Subject	SWS	ECTS
Strategy and Growth in Automotive Sector (Master)	4	5
Corporate Transformation	4	5

Global Foresight and Technology Management - Master

Subject	SWS	ECTS
Smart Factory in discrete Production	4	5
Strategic Information Dynamics in Global Operations and Supply Chains	4	5

Controlling	
Module abbreviation:	EGM_CONTR_E
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 21
Responsible for module:	Eisenberg, Andrea
Lecturers:	Eisenberg, Andrea
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	21: Controlling
Lecture types:	SU/Ü-Lecture with exercises
Studien- / Prüfungsleistungen:	
21: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Students</p> <ul style="list-style-type: none"> understand the meaning of strategic management and the role of management accounting. can apply the costing approaches target costing and activity-based costing to business cases. can calculate different key financial indicators and interpret them. are able to make investment decisions based on static and dynamic methods. can prepare budgets, both static and a flexible budgets, can perform a detailed variance analysis and can calculate the elements of the working capital life cycle. can solve case studies by applying the knowledge acquired in the class. 	
Content:	
<ul style="list-style-type: none"> Controlling and Management accounting Strategic management and management accounting Strategy formulation, implementation and evaluation Modern costing approaches: Target Costing and Activity-based costing Investment appraisal: Static and dynamic methods Key Financial indicators, value-based and profitability ratios Budgeting, budgeting process, static and flexible budgets, working-life cycle Case studies 	
Literature:	
<ul style="list-style-type: none"> WEETMAN, Pauline and Darren JUBB, 2024. <i>Financial and management accounting: an introduction</i>. Harlow, England: Pearson. ISBN 978-1-292-45704-8 DAVID, Fred R., Forest R. DAVID and Meredith E. DAVID, 2023. <i>Strategic management: concepts and cases : a competitive advantage approach</i>. Harlow, England: Pearson. ISBN 978-1-292-44140-5, 1-292-44140-2 	

- GRANT, Robert M., 2025. *Contemporary strategy analysis*. Hoboken, NJ: Wiley. ISBN 978-1-394-25159-9

Corporate Transformation - Master	
Module abbreviation:	WMod_CorpTrans_M-EGM
Curriculum:	Programmes
	Master Wirtschaftsingenieurwesen (M-WI) - SPO-Nr.: 7
Responsible for module:	Kalmbach, Ralf
Lecturers:	Kalmbach, Ralf
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	7: Corporate Transformation
Lecture types:	SU/Ü-Lecture with practical exercises
Studien- / Prüfungsleistungen:	
7: Student research project with presentation Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>This module will provide a comprehensive understanding of the key elements and success factors as well as the design and management of a corporate transformation program.</p> <p>After attending the course, the students:</p> <ul style="list-style-type: none"> • will be able to understand the need and magnitude of change, the approach and design as well as the management of a corporate transformation program. • will have knowledge about success factors and roadblocks in such programs and develop understanding of how to overcome the classical pitfalls. • will touch reality by walking through case studies of successful and failed transformations. 	
Content:	
<ul style="list-style-type: none"> • Purpose: Refreshing the organization's reason for being • Full Potential Plan: Diagnosis of current performance and strategic position to identify the most important disruptive factors and important value levers to win today and in the future • Leadership: Building a high performing, aligned, committed leadership team, and assign top talent to the critical roles that will drive the most value • Program Design: Setting up an operating model that allows to run and change the business at the same time • Results Delivery: Rapidly delivering value by innovating, testing, and scaling solutions • Orchestration: Building capabilities, boosting accountability, and managing change to realize rapid sustainable results • Communication and Culture: Communication and behavior is key to "onboard" all relevant stakeholder and capture / energize the key people to support the transformation and creating a winning team / culture 	

Literature:

- DALPIAZ, E., DI STEFANO, G., 2018. A universe of stories: Mobilizing narrative practices during transformative change. In: *Strategic Management*. (39 (3)), p.664-696.
- BLENKO, Marcia W., Michael C. MANKINS and Paul ROGERS, 2010. *Decide & Deliver: 5 Steps to Breakthrough Performance in your Organization*. Harvard: Harvard Business Press.
- MANKINS, Michael and Patrick LITRE , 2024. *Middle Managers Should Drive Your Business Transformation*.
- HITT, M. A., HAYNES, K. T., SERPA, R. , 2010. Strategic leadership for the 21st Century. In: *Business Horizons*. (53(5)), p.437–444.
- KARTAWIJAYA, T., 2022. HBR Case Study: Organizational Change. In: *Harvard Business Review*.
- KOTTER , J., 2012. Leading Change. In: *Harvard Business Review Press*.
- CHIDI , Ameke, 2021. *Purpose-Driven Transformation: The Corporate Leader’s Guide to Value Creation and Growth*.
- LOPARO, K., 2014. *The Executive Guide to Corporate Restructuring*.
- FURR, N., 2018. Leading Transformation: How to Change Your Company’s Future. In: *Harvard Business Review Press*.

Electrical Engineering	
Module abbreviation:	EGM_ETEC_E
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 13
Responsible for module:	Haug, Thomas
Lecturers:	Haug, Thomas
Language of instruction:	English
Credit points / SWS:	5 ECTS / 5 SWS
Workload:	Contact hours: 58 h
	Self-study: 67 h
	Total: 125 h
Subjects of the module:	13: Electrical Engineering
Lecture types:	SU/Ü-Lecture with exercises
Studien- / Prüfungsleistungen:	
<p>13: schrP90 - written exam, 90 minutes</p> <p>Additional Explanation: written exam, 90 minutes</p> <p>permitted aids: pocket calculator, not programmable any written documents (printed or handwritten)</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>After participating in the module courses, students are able to</p> <ul style="list-style-type: none"> • use the basic physical laws of electrical engineering and understand their relations. • calculate with electrical and magnetic field quantities. • analyze direct current and alternating current networks. • calculate alternating current networks with the help of complex numbers and phasors. • explain the principles of semiconductor technology and of the most important electronic components. • familiarise themselves with subjects regarding electrical engineering self-reliant and within a team and are able to discuss these matters competently. 	
Content:	
<ul style="list-style-type: none"> • Direct current circuits: voltage, current, Ohm's law, energy, power, Kirchhoff's laws, Thevenin equivalent, Norton equivalent circuit, series connection, parallel connection, maximum power transfer, calculation of networks • Electric field: electric field quantities, capacitance, energy in the electrostatic field, forces in the electrostatic field, switching operations • Magnetic field: magnetic field quantities, coil inductance, magnetic circuit, magnetic flux law, magnetic energy of the coil, forces in the magnetic field, induction law, self-induction, switching operations • Alternating current circuit: sinusoidal change of electric quantities, circuit analysis of alternating current networks, power, frequency response, transformers • Three-phase system: star connection, delta connection, power, symmetrical load, asymmetrical load • Semiconductors: diode, transistor, operational amplifier, basics of electric circuits • Measuring electric quantities 	

Literature:

- HACKER, Viktor, SUMEREDER, Christof, 2020. *Electrical engineering: fundamentals* [online]. München ; Wien: De Gruyter Oldenbourg PDF e-Book. ISBN 978-3-11-052111-5, 978-3-11-052113-9. Available via: <https://doi.org/10.1515/9783110521115>.
- N. MAKAROV, Sergey, LUDWIG, Reinhold, BITAR, Stephen J., 2019. *Practical Electrical Engineering* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-319-96692-2. Available via: <https://doi.org/10.1007/978-3-319-96692-2>.
- HAGMANN, Gert, 2020. *Grundlagen der Elektrotechnik: das bewährte Lehrbuch für Studierende der Elektrotechnik und anderer technischer Studiengänge ab 1. Semester*. 18. edition. Wiebelsheim: AULA-Verlag. ISBN 978-3-89104-830-6, 3-89104-830-0
- TIPLER, Paul Allen and Gene MOSCA, 2008. *Physics for scientists and engineers*. New York: Freeman. ISBN 978-1-4292-0124-7, 1-4292-0124-X

Financial Accounting	
Module abbreviation:	FINACC_EGM_E
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 10
Responsible for module:	Eisenberg, Andrea
Lecturers:	Eisenberg, Andrea
Language of instruction:	English
Credit points / SWS:	5 ECTS / 5 SWS
Workload:	Contact hours: 58 h
	Self-study: 67 h
	Total: 125 h
Subjects of the module:	10: Financial Accounting
Lecture types:	SU/Ü-lecture with exercises
Studien- / Prüfungsleistungen:	
10: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Students</p> <ul style="list-style-type: none"> gain an understanding of the theoretical background of financial accounting. know how to analyze the structure and the positions of a balance sheet and can determine the initial value and the subsequent measurement of balance sheet positions based on different accounting standards. can solve business problems according to German GAAP and IFRS accounting. can analyze the content of an annual reports. can prepare balance sheets, profit and loss accounts and cash flow statements for several years. 	
Content:	
<ul style="list-style-type: none"> Basic principles of accounting German and European accounting principles and IFRS accounting standards Balance Sheet: structure and balance sheet positions, initial recognition and subsequent measurement according to German GAAP and according to IFRS Profit and loss accounts: structure and positions, determination of profit according to German GAAP, EU directive and according to IFRS Accruals accounting Cash effective and non-cash effective transactions, cash flow statements Annual reports Case study: Founding and closing of a firm over six periods, preparation of balance sheet, profit and loss accounts and cash flow statements for each period Weekly exercise session 	

Literature:

- WEETMAN, Pauline and Darren JUBB, 2024. *Financial accounting: an introduction*. Harlow, England: Pearson. ISBN 978-1-292-45706-2
- ALEXANDER, David and Christopher NOBES, 2020. *Financial accounting: an international introduction*. Harlow, England: Pearson. ISBN 978-1-292-29585-5
- IASB, . *IAS 1, 16, 36: International Accounting Standards*.

Mathematics 2	
Module abbreviation:	MA2_EGM_E
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 2
Responsible for module:	Schlickewei, Ulrich
Lecturers:	Schlickewei, Ulrich
Language of instruction:	English
Credit points / SWS:	5 ECTS / 5 SWS
Workload:	Contact hours: 58 h
	Self-study: 67 h
	Total: 125 h
Subjects of the module:	2: Mathematics 2
Lecture types:	SU/Ü-Lecture with exercises
Studien- / Prüfungsleistungen:	
2: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
Mathematics 1	
Objectives:	
<p>Students:</p> <ul style="list-style-type: none"> • have further developed their ability to recognize which questions in engineering sciences can be tackled by mathematical methods, and are able to post such questions themselves. • understand the logical way of reasoning, distinguish between a premise, a consequence, and a rule, and, furthermore, are able to build a line of argument within engineering applications. • recognize known types of problems both in familiar and in new contexts, can solve such problems using known methods. • understand the mathematical language used in the engineering literature and are able to describe in both oral and written form their own reasoning and solution approaches. • have acquired confidence in handling the discussed mathematical methods. 	
Content:	
<ul style="list-style-type: none"> • Basic linear algebra: vectors, matrices, linear systems of equations, determinants, inverse matrices • Eigenvalues and eigenvectors of matrices, diagonalization, quadratic forms, applications • Ordinary differential equations: basics, solution methods, applications • Differentiation in \mathbb{R}^n: basics, rules, applications • Integration in \mathbb{R}^n: basics, methods of integration, applications • Curves: basics, vector analysis, applications 	
Literature:	
<ul style="list-style-type: none"> • STRANG, Gilbert, 2017. <i>Calculus</i>. Wellesley, MA: Wellesley-Cambridge Press. ISBN 978-0-9802327-5-2 • STEWART, James, 2016. <i>Calculus</i>. Belmont, Calif.: Thomson Brooks/Cole. ISBN 978-1-305-26672-8, 1-305-26672-2 • STRANG, Gilbert, 2021. <i>Introduction to linear algebra</i>. Wellesley: Cambridge Press. ISBN 978-1-7331466-5-4, 1-7331466-5-2 	

- LAY, David C., Steven R. LAY and Judi J. MCDONALD, 2022. *Linear algebra and its applications*. Boston: Pearson. ISBN 978-1-292-35122-3
- HARTMAN, Gregory, FITZPATRICK, Sean, JORDAN, Alex, VOLLET, Carly, 2018. *APEX Calculus* [online]. PDF e-Book. Available via: <https://opentext.uleth.ca/apex-calculus/apex-calculus.html>.
- HARTMAN, Gregory, STITZ, Carl, ZEAGER, Jeff, FITZPATRICK, Sean. *Elementary Linear Algebra* [online]. PDF e-Book. Available via: <https://opentext.uleth.ca/Math1410/>.
- ARENS, Tilo and ET AL., 2015. *Mathematik*. Berlin [u.a.]: Springer Spektrum. ISBN 978-3-642-44918-5, 978-3-642-44919-2
- PAPULA, Lothar, . *Mathematik für Ingenieure und Naturwissenschaftler*.
- KOCH, Jürgen and Martin STÄMPFLE, 2018. *Mathematik für das Ingenieurstudium*. München: Hanser. ISBN 978-3-446-45166-7, 3-446-45166-8

Mechanical Design 1	
Module abbreviation:	MD1_EGM_E
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 5
Responsible for module:	Tröber, Philipp
Lecturers:	Tröber, Philipp
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	5: Mechanical Design 1
Lecture types:	SU/Ü-Lecture with exercises
Studien- / Prüfungsleistungen:	
5: schrP120 - written exam, 120 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>At the end of the course, students are able to</p> <ul style="list-style-type: none"> reproduce specific terms, definitions and which standards have to be taken into account regarding the creation of technical drawings create complete and standardized graphic representations of technical components apply the different projection methods select tolerances and fits appropriate to function and production evaluate the mountability of an assembly by a tolerance stack develop new components and assemblies by linking their knowledge and design them for production 	
Content:	
<ul style="list-style-type: none"> Symbolic representations used in technical drawings Projection methods for the graphic representation of technical components and products All views of a component including sectional views, detailed views Dimensioning of components with regard to function, manufacturing and inspection as well as the associated dimensioning rules ISO tolerance system, free and general tolerances, shape and position tolerances, tolerance stack-up Surface specifications Typical machine elements and standard parts and their graphic representation Design guidelines for various manufacturing processes Creation of freehand sketches Geometrical product specification 	

Literature:

- GOMERINGER, Roland and others, 2018. *Mechanical and Metal Trades Handbook*. Haan-Gruiten: Verlag Europa-Lehrmittel, Nourney, Vollmer GmbH & Co. KG. ISBN 978-3-8085-1915-8, 3-8085-1915-0

Power Engineering	
Module abbreviation:	POWE_EGM
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 17
Responsible for module:	Bschorer, Sabine
Lecturers:	Bschorer, Sabine
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	17: Power Engineering
Lecture types:	SU/Ü/Pr-Lecture with exercises and practical courses
Studien- / Prüfungsleistungen:	
17: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After attending the module courses, participants will be able to</p> <ul style="list-style-type: none"> • correctly apply the subject-specific terminology. • describe and evaluate the most important methods of energy conversion and discuss their pros and cons. • evaluate and calculate fundamental problems of thermodynamics (e.g. enthalpy, entropy, T-s-diagram, heat transfer) and fluid dynamics. • calculate and evaluate cyclic processes. • estimate the efficiency of different methods of power and heat generation. • discuss and evaluate the social relevance and the environmental effects of the different energy technologies. 	
Content:	
<ul style="list-style-type: none"> • The actual situation of energy supply • Influence on environment and climate • Thermal cycles for power and heat generation <ul style="list-style-type: none"> ○ Steam and gas turbine process ○ The combined cycle power plant ○ Combined heat and power plant (CHP) • Use of nuclear power • Basics of renewable energy • Hydropower; wind power; biomass; solar energy • Storage of energy • Laboratory session with wind turbine, CHP, electrolysis/fuel cell, solar technology 	

Literature:

- DEMIREL, Yaşar, 2016. *Energy: Production, Conversion, Storage, Conservation, and Coupling* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-319-29650-0, 978-3-319-29648-7. Available via: <https://doi.org/10.1007/978-3-319-29650-0>.
- QUASCHNING, Volker, 2016. *Understanding renewable energy systems*. London and New York: Routledge. ISBN 978-1-138-78194-8, 978-1-138-78196-2

Production Planning and Logistics	
Module abbreviation:	EGM_PPL_E
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 27
Responsible for module:	Jattke, Andreas
Lecturers:	Jattke, Andreas
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 46 h
	Self-study: 79 h
	Total: 125 h
Subjects of the module:	27: Production Planning and Logistics
Lecture types:	SU/Ü-Lecture with exercises
Studien- / Prüfungsleistungen:	
27: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The students are able to:</p> <ul style="list-style-type: none"> • select production planning and control methodologies in different branches and sizes of industry. • distinguish production planning philosophies push versus pull. • define adequate KPI's to control the success of production planning methodologies. • define production planning methodologies in the whole supply chain including external customers and suppliers. • integrate the meaning of PPS systems in line with digitalisation in industry 4.0. <p>For dual students:</p> <p>Dual students have reflected experiences from their partner companies in the light of the learned methods of production planning and logistics. They are capable to explain their application in concrete practice examples from their partner companies. Additionally, they are in a position to analyse and judge the method of production planning implemented in their partner company.</p>	
Content:	
<ul style="list-style-type: none"> • PPC Strategies • Production Programme Planning and Lot sizing • Order and Capacity Scheduling • Integration of PPC in ERP and Industry 4.0 • Production Controlling and KPI's • Different examples from industry 	
Literature:	
<ul style="list-style-type: none"> • BUZACOTT, John A., 2013. <i>Production planning and control: basics and concepts</i>. München: Oldenbourg. ISBN 978-3-486-72247-5, 3-486-72247-6 	

Production systems	
Module abbreviation:	PRODSYS_EGM_E
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 11
Responsible for module:	Meyer, Roland
Lecturers:	Meyer, Roland
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 43 h
	Total: 125 h
Subjects of the module:	11: Production systems
Lecture types:	SU/Ü/Pr-Lecture with exercises and practical course
Studien- / Prüfungsleistungen:	
11: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After attending this lecture students will be able to:</p> <ul style="list-style-type: none"> • know and be secure with the areas, elements and typical terms of production engineering. • know state of art, basic ways of organizing and applying production systems. • understand and asses the concept of added value, waste and profitability in production. • recognize, describe and asses types of machine tools and their applications. • incorporate and contribute to tasks within an industrial produciton planning department regarding machining areas and assembly tasks. • solve tasks in designing production systems in teams and are able to present the results. • understand actual digital methods and supports in production systems, the impact and implications of sustainability and apply them to organisation as well as to technology of production systems. 	
Content:	
<ul style="list-style-type: none"> • Introduction • Machine tools • Lean manufacturing • Assembly technology • Digital manufacturing • Sustainable production • Production logistics • Production training • Excursion to production company 	

Literature:

- FREIVALDS, Andris and Benjamin W. NIEBEL, 2014. *Niebel's Methods, standards, and work design*. 13. edition. New York, NY: McGraw-Hill. ISBN 978-0-07-337636-3, 0-07-337636-1
- KOETHER, Reinhard, 2007. *Technische Logistik*. München: Hanser. ISBN 978-3-446-40761-9, 3-446-40761-8
- MARTIN, Heinrich, 2016. *Transport- und Lagerlogistik: Systematik, Planung, Einsatz und Wirtschaftlichkeit*. 10. edition. Wiesbaden: Springer Vieweg. ISBN 978-3-658-14551-4, 3-658-14551-X
- HESSE, Stefan and Viktorio MALISA, 2020. *Grundlagen der Handhabungstechnik*. München: Hanser. ISBN 978-3-446-46335-6
- DANGELMAIER, Wilhelm, 1999. *Fertigungsplanung: Planung von Aufbau und Ablauf der Fertigung Grundlagen, Algorithmen und Beispiele* [online]. Berlin, Heidelberg: Springer Berlin Heidelberg PDF e-Book. ISBN 978-3-642-98045-9, 978-3-642-98046-6. Available via: <https://doi.org/10.1007/978-3-642-98045-9>.
- GOLDRATT, Eliyahu M. and Jeff COX, 2016. *The Goal: A process of ongoing improvement*. Routledge: London and New York. ISBN 978-0-566-08664-9, 978-0-566-08665-6
- KROEMER, Karl H. E., Hiltrud J. KROEMER and Katrin E. KROEMER-ELBERT, 2020. *Engineering physiology: bases of human factors engineering/ergonomics*. Cham, Switzerland: Springer. ISBN 978-3-030-40626-4, 978-3-030-40629-5
- MAYNARD, Harold Bright and others, 2001. *Maynard's industrial engineering handbook*. New York: McGraw-Hill. ISBN 0-07-144927-2, 978-0-07-041102-9
- TAYLOR, Frederick Winslow, 2019. *The principles of scientific management*. Boca Raton: CRC Press; Taylor & Francis Group.
- LIKER, Jeffrey K., 2020. *The Toyota way: 14 management principles from the world's greatest manufacturer*. New York [u.a.]: McGraw-Hill. ISBN 978-1-260-46851-9

R&D-/Technology Management	
Module abbreviation:	R&D_FW
Curriculum:	Programmes
	Engineering and Management (EGM-B) - SPO-Nr.: 28
Responsible for module:	Erdogan, Hüseyin
Lecturers:	Erdogan, Hüseyin
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	28: R&D-/Technology Management
Lecture types:	SU/Ü-Lecture with integrated exercises
Studien- / Prüfungsleistungen:	
28: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After attending this course, students will be able to:</p> <ul style="list-style-type: none"> • get a deeper understanding of the strategic planning, control and monitoring of technology and process innovations. • learn about the tasks of technology management, technology and business planning as well as methods and tools of technology management. • apply methods of idea generation, especially creativity techniques, to concrete practical examples, use methods to evaluate innovations and at the same time conceptually develop the necessary processes. • learn practical methods for core competency analysis for systematic R&D, technology and process management. • to accompany a product idea through technical development into a successful product (up to SOP) and, in addition to the technical solution aspects, also take the economic side into account at an early stage and get to know the company values. • to understand the connection between product and process innovation in particular. 	
Content:	
<ul style="list-style-type: none"> • Innovation culture and success factors for systematic innovation and technology management • Methods of idea generation (creativity techniques) and strategic innovation planning • Core competency analysis • R&D, technology and process management • Agile and sustainable process innovations • Trend analysis • Innovation culture and success factors • Roadmaps • Platform concepts • Knowledge/portfolio/ideas management 	

- Connection between technology and products
- Influence of digitalization on innovation processes
- Getting to know practical examples.

Literature:

- CHAN, Leong, HOGABOAM, Liliya, CAO, Renzhi, 2022. *Applied Artificial Intelligence in Business: Concepts and Cases* [online]. Cham: Springer PDF e-Book. ISBN 978-3-031-05740-3. Available via: <https://doi.org/10.1007/978-3-031-05740-3>.
- LEONARDI, Paul M. and TSEDAL NEELEY, 2022. *The digital mindset: what it really takes to thrive in the age of data, algorithms, and AI*. Boston, Massachusetts: Harvard Business Review Press. ISBN 978-1-64782-010-7, 1-64782-010-3
- CHRISTENSEN, Clayton M., 2016. *The innovator's dilemma: when new technologies cause great firms to fail*. Boston, Mass.: Harvard Business Review Press. ISBN 978-1-63369-178-0
- DAHM, Markus H., BRÜCKNER, Aaron D., 2014. *Operational Excellence mittels Transformation Management: Nachhaltige Veränderung im Unternehmen sicherstellen - Ein Praxisratgeber* [online]. Wiesbaden: Springer Fachmedien Wiesbaden PDF e-Book. ISBN 978-3-658-05092-4, 9783658050917. Available via: <https://doi.org/10.1007/978-3-658-05092-4>.
- DRUMMOND, Graeme, JOHN ENSOR and RUTH ASHFORD, 2008. *Strategic marketing: planning and control*. Amsterdam [u.a.]: Butterworth-Heinemann. ISBN 978-0-7506-8271-8 (pbk.), 0-7506-8271-X (pbk.)
- ROSS, David Frederick, 2000. *Competing through supply chain management: creating market-winning strategies through supply chain partnerships*. Boston [u.a.]: Kluwer. ISBN 0-412-13721-6
- GAUBINGER, Kurt, 2015. *Innovation and Product Management: A Holistic and Practical Approach to Uncertainty Reduction* [online]. Berlin, Heidelberg [u.a.]: Springer Berlin Heidelberg PDF e-Book. ISBN 978-3-642-54376-0. Available via: <https://doi.org/10.1007/978-3-642-54376-0>.
- HOWELLS, John, . *The management of innovation and technology: the shaping of technology and institutions of the market economy*. ISBN 978-1-4462-2058-0
- SHANE, Scott Andrew, 2008. *Handbook of technology and innovation management*. Chichester [u.a.]: Wiley. ISBN 978-1-4051-2791-2
- KRSTIC, Milan, SKORUP, Ana, LAPCEVIC, Goran, 2018. Trends in agile innovation management. In: *International Review*. **2018**(3-4), p.58-70.

Smart Factory in Discrete Production - Master

Module abbreviation:	WMod_SmaFacProd	
Curriculum:	Programmes	
	Global Foresight and Technology Management (M-GFT) - SPO-Nr.: 7	
Responsible for module:	Huber, Walter	
Lecturers:	Huber, Walter	
Language of instruction:	English	
Credit points / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	47 h
	Self-study:	78 h
	Total:	125 h
Subjects of the module:	7:	
Lecture types:	7: SU/Ü - lecture with integrated exercises	
Studien- / Prüfungsleistungen:		
7: LN - written exam, 90 minutes Additional Explanation: None		
Recommended prerequisites:		
None		
Objectives:		
After attending the course students are able to: 1. generate basic understanding of relevant Business Processes. <ul style="list-style-type: none">• develop an understanding in Smart Factory technologies.• get insights in the challenges of digital transformation.• see how a transformation process to reach out a Smart Factory.• understand the challenges of Leadership in the digital area.		
Content:		
2. Big Picture of Smart Factory <ul style="list-style-type: none">• Backend-Systeme (ERP, MES)• CPS like Sensors, AGVs, Robotik (incl. humanoide Robots)• Paperless Production (Shift planning, Qualifications)• Simulation (Value stream, virtuell commissioning)• OT-Security• KI-based Production systems• Relevants of Standards• Digital Twin• Organisational aspects• Digital Leadership and Transformation• Change Management		

Literature:

3. HUBER, Walter, 2018. *Industrie 4.0 kompakt - Wie Technologien unsere Wirtschaft und unsere Unternehmen verändern: Transformation und Veränderung des gesamten Unternehmens*. Wiesbaden: Springer Vieweg. ISBN 978-3-658-20798-4, 3-658-20798-1
 - HUBER, Walter, 2016. *Industrie 4.0 in der Automobilproduktion: ein Praxisbuch*. Wiesbaden: Springer Fachmedien Wiesbaden GmbH. ISBN 978-3-658-12731-2, 3-658-12731-7
 - BEBERSDORF, Peter, HUCHZERMEIER, Arnd, 2021. *Variabler Takt: mit dem VarioTakt Varianz beherrschen bei grenzenloser Produktindividualisierung* [online]. Berlin: Springer Gabler PDF e-Book. ISBN 978-3-662-63931-3. Available via: <https://doi.org/10.1007/978-3-662-63931-3>.
 - BRAUCKMANN, Otto, 2015. *Smart Production: Wertschöpfung durch Geschäftsmodelle*. Berlin: Springer Vieweg. ISBN 978-3-662-45301-8, 978-3-662-45301-8
 - SCHULZ, Thomas , 2019. *Cybersicherheit: für vernetzte Anwendungen in der Industrie 4.0*. ISBN 978-3834334244
 - ZIEMKE, André , Thomas STÖCKEL and Lars THOMSON , 2016. *Produktion 4.0: Neue Wege für die Automobilindustrie*. ISBN 13-978-3981636055
 - FRIESIKE, Sascha and Johanna SPRONDEL, 2022. *Träge Transformation. Welche Denkfehler den digitalen Wandel blockieren..* ISBN 13-978-3150141885
 - Without author. *Industrie 4.0 Interoperabilität durch OPC UA mit Companion Specifications Mehrwerte für Stakeholder des Maschinen- und Anlagenbaus* [online]. [Accessed on:]. Available via: https://www.vdma.eu/documents/34570/77803117/VDMA_Leitfaden_Mehrwerte_DE.pdf
 - Without author. *Catena X Sonderheft automotiveIT & Automobil Produktion* [online]. , 2025 [Accessed on:]. Available via: <https://de.scribd.com/document/869420247/Catena-x-Sonderheft-Automotiveit-Automobil-Produktion-2025-1>
 - HERWIG, Tobias. *Fabrik der Zukunft - Inspirationen für die Produktion und Logistik von morgen! (Podcast)* [online]. , 2025 [Accessed on:]. Available via: <https://podcast.fabrikderzukunft.com/>
 - KOARK, Anne , RAMIN, Philipp . *DigiKompetenz Podcast - Der Podcast zur digitalen Kompetenzentwicklung* [online]. , 2025 [Accessed on:]. Available via: <https://www.i40.de/digikompetenzpodcast>

Strategy and Growth in Automotive Sector - Master	
Module abbreviation:	WMod_StrGroAutSc_M-GFT
Curriculum:	Programmes
	Engineering and Management (M-EGM) - SPO-Nr.: 11
Responsible for module:	Rengarajan, Srinath
Lecturers:	Rengarajan, Srinath
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 79 h
	Total: 126 h
Subjects of the module:	11: Strategy and Growth in Automotive Sector
Lecture types:	SU/Ü-Lecture with practical exercises
Studien- / Prüfungsleistungen:	
11: LN - project work Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After attending the course, the students will be able to</p> <ul style="list-style-type: none"> • understand trends of strategy management and application of strategy tools and frameworks in the automotive sector based on multiple real-world case examples. • gain an overview of megatrends and technological developments in the global automotive sector, including new business models incorporating ecosystem and platform approaches. • develop an international perspective on the activities and strategies of established automotive companies, including the intricacies in market entry and growth strategies. • analyse the product and mobility solutions portfolios and corporate strategies of global automakers from a positioning and competition perspective. 	
Content:	
<ul style="list-style-type: none"> • Strategy management: Introduction, Corporate & Competitive Strategy, Strategy Tripod, M&A and Alliances, Strategy Tools/Frameworks and their applications • Automotive trends: Megatrends, Connected, Autonomous, Electric, Shared • International management: Global growth, Market entry, CSA/FSA, Reshoring. business strategies for emerging markets • Dealing with uncertainty: decision intelligence framework • Business ecosystems, marketplaces and platforms, as-a-Service models 	
Literature:	
<ul style="list-style-type: none"> • MINTZBERG, Henry, Bruce W. AHLSTRAND and Joseph LAMPEL, 2005. <i>Strategy safari: a guided tour through the wilds of strategic management</i>. New York: Free Press. ISBN 978-0-7432-7057-1, 0-7432-7057-6 • NIEUWENHUIS, Paul and Peter WELLS, 2015. <i>The global automotive industry</i>. Chichester, UK: Wiley. ISBN 978-1-118-80239-7 	

- TRAUB-MERZ, Rudolf, 2017. *The Automotive Sector in Emerging Economies: Industrial Policies, Market Dynamics and Trade Unions. Trends & Perspectives in Brazil, China, India, Mexico and Russia*. Berlin : Friedrich-Ebert-Stiftung. ISBN 978-3-95861-597-7
- ACEA, . *The Automobile Industry Pocket Guide 2024/2025 [online]* [online]. , 2024. [Accessed on:]. Available via: <https://www.acea.auto/publication/the-automobile-industry-pocket-guide-2024-2025/>

Strategic Information Dynamics in Global Operations and Supply Chains - Master

Module abbreviation:	WMod_Strat InfDynam	
Curriculum:	Programmes	
	Global Foresight and Technology Management (M-GFT) - SPO-Nr.: 7	
Responsible for module:	Bhardwaj, Debarshee	
Lecturers:	Bhardwaj, Debarshee	
Language of instruction:	English	
Credit points / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	47 h
	Self-study:	78 h
	Total:	125 h
Subjects of the module:	7: Strategic Information Dynamics in Global Operations and Supply Chains	
Lecture types:	7: SU/Ü - lecture with integrated exercises	
Studien- / Prüfungsleistungen:		
7: LN - written exam, 90 minutes Additional Explanation: Short technical report with oral presentation.		
Recommended prerequisites:		
None		
Objectives:		
Students will be able to		
4. understand key principles of global operations and supply chain management. <ul style="list-style-type: none"> • analyse information flows and data in supply chain decision-making. • identify and solve coordination and integration problems in global supply chains. • apply analytical tools to case data and develop evidence-based solutions. • present findings and collaborate effectively in case-based group work. 		
Content:		
The course integrates foundational lectures with intensive case-based group work. It consists of three main components:		
1. Introductory Lecture/s:		
5. Fundamentals of logistics, global operations, and supply chain management <ul style="list-style-type: none"> • Information and data processing in supply chain decision-making • Information quality, uncertainty, and demand/supply planning • Information systems for SCM (MRP, ERP, EDI, RFID, analytics, dashboards) • Global supply chain structures, risk, disruptions, and emerging technologies (AI, IoT, blockchain) 		
2. Case-Based Sessions:		
Students work in groups on company-specific cases that reflect real challenges in:		
6. Coordination and integration problems (e.g., bullwhip effect, sourcing complexity) <ul style="list-style-type: none"> • Global production and network design • Supplier selection, outsourcing/offshoring, and procurement • Logistics, distribution, and cross-border operations 		

- Information flow design, data analysis, forecasting, and planning
- Lean, agile, and responsive supply chain philosophies
- Each case includes structured data analysis tasks and guiding questions.

Working with structured datasets and guiding questions, students analyse operational problems and apply relevant supply chain frameworks. The course concludes with a comprehensive integrative case in which teams synthesize their learning and present their analysis and recommendations.

Literature:

- 7.** SKJOTT-LARSEN, Tage, 2007. *Managing the global supply chain*. Copenhagen: Copenhagen Business School. ISBN 978-87-630-0171-7



Course Descriptions

Electrical Engineering and Information Technology

International Office

Summer term 2026

As per: 2026-02-02

This program and course description becomes effective on 15.03.2026. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations.

AI Engineering of Autonomous Systems - Master

Subject	SWS	ECTS
Computing and Connectivity Technologies	4	5
Machine Perception and Cognition	4	5
Optimization Methods for Machine Learning	4	5
Verification of Machine Learning Algorithms	4	5

Autonomous Vehicle Engineering (AVE)

Subject	SWS	ECTS
Computer Vision	4	5
Mathematics 2	5	6
Exercise Course Mathematics 2	1	0
Planning and Decision-Making Algorithms	4	5
Sensor Data Processing and Sensor Data Fusion	6	7
Practical Course Sensor Data Processing and Sensor Data Fusion	2	0
Vehicle Actuators	4	5
Vehicle-to-X-Communication	4	5

International Automotive Engineering (IAE) **Master**

Subject	SWS	ECTS
Artificial Intelligence and Automotive Systems	4	5
Automotive Electrical and Electronic Technology	4	5
Integrated Safety and Assistance Systems	4	5
Testing and Simulation Methods for Vehicle Safety	4	5
Vehicle Dynamics	4	5

Artificial Intelligence and Automotive Systems - Master	
Module abbreviation:	IAE_AIAS
Curriculum:	Programmes
	International Automotive Engineering (IAE-M) - SPO-Nr.: 17
Responsible for module:	Zimmer, Alessandro
Lecturers:	Zimmer, Alessandro
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 79 h
	Total: 126 h
Subjects of the module:	Artificial Intelligence and Automotive Systems: Artificial Intelligence and Automotive Systems
Lecture types:	Artificial Intelligence and Automotive Systems: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Artificial Intelligence and Automotive Systems: LN - written exam, 90 minutes	
Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
After successfully completing the module the students shall be able to	
<ul style="list-style-type: none"> understand the basic principles that lie behind different Artificial Intelligence techniques that can be used in the context of automotive systems. identify the most suitable Artificial Intelligence techniques to be used in a given scenario. model a problem of automotive safety using Artificial Intelligence systems. implement basic intelligent algorithms in Matlab. 	
Content:	
<ul style="list-style-type: none"> Introduction to AI. Problems and search space. Knowledge representation and Pattern Recognition. AI and Automotive Systems/Automotive Safety Systems. Theory, concepts and applications of Neural Networks. Neurodynamics, topology of Neural Networks and learning methods. Fuzzy sets and systems. Modelling of Fuzzy System's Applications. Concepts of Evolutionary Systems. Genetic Algorithms and optimization problems. 	
Literature:	
<ul style="list-style-type: none"> RUSSELL, Stuart J. and Peter NORVIG, 2021. <i>Artificial intelligence: a modern approach</i>. Hoboken: Pearson. ISBN 978-0-13-461099-3 MICHELUCCI, Umberto, 2018. <i>Applied deep learning: a case-based approach to understanding deep neural networks</i> [online]. Berkeley, CA: Apress PDF e-Book. ISBN 978-1-4842-3790-8. Available via: https://doi.org/10.1007/978-1-4842-3790-8. SINGH, Himanshu, LONE, Yunis Ahmad, 2020. <i>Deep Neuro-Fuzzy Systems with Python: With Case Studies and Applications from the Industry</i> [online]. Berkeley, CA: Apress PDF e-Book. ISBN 978-1-4842-5361-8. Available via: https://doi.org/10.1007/978-1-4842-5361-8. 	

- BUONTEMPO, Frances and Tammy CORON, January 2019. *Genetic algorithms and machine learning for programmers: create AI models and evolve solutions*. Book version: P 1. edition. Raleigh, North Carolina: The Pragmatic Bookshelf. ISBN 978-1-68050-620-4
- ESCALANTE, Hugo Jair, 2018. *Explainable and Interpretable Models in Computer Vision and Machine Learning* [online]. Cham: Springer PDF e-Book. ISBN 978-3-319-98131-4. Available via: <https://doi.org/10.1007/978-3-319-98131-4>.

Automotive Electrical and Electronic Technology - Master	
Module abbreviation:	IAE_ElecTechn
Curriculum:	Programmes
	International Automotive Engineering (IAE-M) - SPO-Nr.: 4
Responsible for module:	Arnold, Armin
Lecturers:	Arnold, Armin
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Automotive Electrical and Electronic Technology: Automotive Electrical and Electronic Technology
Lecture types:	Automotive Electrical and Electronic Technology: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Automotive Electrical and Electronic Technology: schrP90 - written exam, 90 minutes	
Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After successfully completing the master's thesis, students are able to</p> <ul style="list-style-type: none"> • have acquainted the special characteristics and specifications of electronic systems in vehicles. • understand the specific characteristics of the most important sensors and actuators and are able to select the appropriate components for any given problem. • know the electric architecture of automotive control units and applied integrated circuits. • know about different vehicle networks and can explain the communication principles of the corresponding electronic components. 	
Content:	
<ul style="list-style-type: none"> • basics of electrical and electronic engineering • introduction to sensor and actuator technology • basic functionalities of different bus systems • control unit circuits for input and sensor signal conditioning, output drivers and controlling actuators, power supply • physical layer of automotive communication networks and onboard communication • introduction to automotive electric standards 	
Literature:	
<ul style="list-style-type: none"> • ZAMAN, Najamuz, 2015. <i>Automotive electronics design fundamentals</i> [online]. Cham [u.a.]: Springer PDF e-Book. ISBN 978-3-319-17584-3. Available via: https://doi.org/10.1007/978-3-319-17584-3. • IDA, Nathan, 2021. <i>Engineering Electromagnetics</i> [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-030-15557-5. Available via: https://doi.org/10.1007/978-3-030-15557-5. 	

- ROBERT BOSCH GMBH (ED.), 2014. *Bosch Automotive Electrics and Automotive Electronics: Systems and Components, Networking and Hybrid Drive* [online]. PDF e-Book. ISBN 978-3-658-01784-2. Available via: <https://doi.org/10.1007/978-3-658-01784-2>.

Computer Vision	
Module abbreviation:	AVE_CV
Curriculum:	Programmes
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 25
Responsible for module:	Schall, Martin
Lecturers:	Schall, Martin
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Computer Vision
Lecture types:	SU - lecture
Studien- / Prüfungsleistungen:	
LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
After successfully completing this module the students shall be able to	
<ol style="list-style-type: none"> 1 understand pinhole cameras and their geometry. 2 understand camera sensors and the Bayer filter. 3 understand convolutions in 1D and 2D. 4 understand basic computer vision operations. 5 understand the basics of artificial neural networks. 6 understand convolutional neural networks (CNNs). 7 understand stereo estimation and motion estimation. 	
Content:	
<ol style="list-style-type: none"> 8 Affine transformations. 9 Camera models and the pinhole camera. 10 Camera sensors, Bayer filter and color spaces. 11 Convolutions in 1D and 2D. 12 Edge and corner detectors. 13 Stereo estimation. 14 Motion estimation. 15 Image segmentation. 16 Perceptron and multi-layer perceptron. 17 Gradient descent and backpropagation. 18 Convolutional neural networks (CNNs) and their applications. 19 Autoencoders and their applications. 20 U-Nets and their applications. 	

Literature:
Will be specified at the beginning

Computing and Connectivity Technologies - Master	
Module abbreviation:	AI_CompConn
Curriculum:	Programmes
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 8
Responsible for module:	Festag, Andreas
Lecturers:	Festag, Andreas; Hagerer, Andreas
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Computing and Connectivity Technologies: Computing and Connectivity Technologies
Lecture types:	Computing and Connectivity Technologies: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Computing and Connectivity Technologies: mdIP - oral exam - 15 - 30 min. Additional Explanation: None	
Recommended prerequisites:	
internet / OSI layer model; digital communications	
Objectives:	
<p>Upon completion of the module, students will be able to:</p> <ul style="list-style-type: none"> • Describe architecture, organisation and execution concepts of basic and advanced processing technologies (CPU, ISP, GPU, TPU) used to handle requirements of various applications of autonomous systems efficiently. • Explain the execution of program elements by various processing technologies. • Describe concepts of interconnection technologies for processor to memory communication and processor to processor communication. • Describe the requirements, use cases, architectures and communication technologies for exchanging information among autonomous systems. • Understand transmission and media access methods, communication protocols of the network, transport and facilities layer as well as data security and system management. • Evaluate the advantages and disadvantages of current technological capabilities to deliver uninterrupted connectivity that is interoperable between different kind of mobile units, satellites and command centres and assess future developments. 	
Content:	
<p>Computing Technology:</p> <ul style="list-style-type: none"> • organisation and architecture of computing systems: CPU, ISP, GPU, Multi-GPUs, distributed GPUs • programming concepts for CPUs and GPUs • interconnection structures • domain-specific architectures like TPUs • use case: distributed machine learning <p>Connectivity Technology:</p>	

- Car2X use cases and system architecture
- WLAN-V2X and Cellular-V2X
- Architecture, channel structure, synchronisation, resource management, scheduling and overload control
- IP mobility support and ad hoc networking for Car2X

Literature:

- KUROSE, James F. and Keith W. ROSS, 2022. *Computer networking: a top-down approach*. Harlow, United Kingdom: Pearson. ISBN 978-1-292-40546-9, 1-292-40546-5
- GEETHA, T V, SENDHILKUMAR, S, 2023. *Machine Learning: concepts, techniques and applications* [online]. Boca Raton, London, New York: CRC Press, Taylor & Francis Group PDF e-Book. ISBN 978-1-003-29010-0. Available via: <https://doi.org/10.1201/9781003290100>.
- VAIDYA, Bhaumik, September 2018. *Hands-on GPU-accelerated computer vision with OpenCV and CUDA: effective techniques for processing complex image data in real time using GPUs*. Birmingham ; Mumbai: Packt. ISBN 978-1-78934-368-7
- TROPPENS, Ulf, 2009. *Storage networks explained: basics and application of Fibre Channel SAN, NAS, iSCSI, InfiniBand, and FCoE*. Hoboken, NJ: John Wiley. ISBN 978-0-470-74143-6
- CHAKRAVARTHI, Veena S., KOTESHWAR, Shivananda R., 2023. *System on Chip (SOC) Architecture: A Practical Approach* [online]. Cham: Springer Nature Switzerland PDF e-Book. ISBN 978-3-031-36242-2. Available via: <https://doi.org/10.1007/978-3-031-36242-2>.

Integrated Safety and Assistance Systems - Master	
Module abbreviation:	IAE_ISAS
Curriculum:	Programmes
	International Automotive Engineering (IAE-M) - SPO-Nr.: 12
Responsible for module:	Botsch, Michael
Lecturers:	Botsch, Michael; Dirndorfer, Tobias
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Integrated Safety and Assistance Systems: Integrated Safety and Assistance Systems
Lecture types:	Integrated Safety and Assistance Systems: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Integrated Safety and Assistance Systems: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After successfully completing the master's thesis, students are able to</p> <ul style="list-style-type: none"> to explain basic vehicle components that are required for driver assistance systems and for vehicle integrated safety functions. to analyze and evaluate state of the art driver assistance systems. to describe testing procedures that are used for vehicle active safety functions. to explain mathematically the concepts for motion planning that are used in algorithms for driver assistance systems and integrated safety functions. to implement basic trajectory planning algorithms in Matlab. 	
Content:	
<ul style="list-style-type: none"> introduction to IS & DAS examples of driver assistance and integrated vehicle safety systems: parking systems, adaptive cruise control, autonomous emergency braking position and orientation: pose, representing pose in 2-D and in 3-D time and motion: generation of trajectories, rate of change and inverse problem vehicle motion models: decoupled X- and Y-dynamics, constant velocity model, constant steering angle and velocity model, constant turn rate and acceleration model, one-track model, two-track model navigation and localization 	
Literature:	
<ul style="list-style-type: none"> KELLY, Alonzo, 2013. <i>Mobile robotics: mathematics, models, and methods</i>. New York, NY: Cambridge Univ. Press. ISBN 978-1-107-03115-9 	

- HEISSING, Bernd, 2011. *Chassis handbook: fundamentals, driving dynamics, components, mechatronics, perspectives* [online]. Wiesbaden: Vieweg+Teubner PDF e-Book. ISBN 978-3-8348-9789-3. Available via: <https://doi.org/10.1007/978-3-8348-9789-3>.
- WINNER, Hermann, HAKULI, Stephan, LOTZ, Felix, SINGER, Christina, 2019-. *Handbook of Driver Assistance Systems: Basic Information, Components and Systems for Active Safety and Comfort* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-319-09840-1. Available via: <https://doi.org/10.1007/978-3-319-09840-1>.
- BOTSCH, Michael, UTSCHICK, Wolfgang, 2020. *Fahrzeugsicherheit und automatisiertes Fahren: Methoden der Signalverarbeitung und des maschinellen Lernens* [online]. PDF e-Book. ISBN 978-3-446-46804-7.

Machine Perception and Cognition - Master	
Module abbreviation:	AI_MachPerception
Curriculum:	Programmes
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 1
Responsible for module:	Schall, Martin
Lecturers:	Schall, Martin
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Machine Perception and Cognition: Machine Perception and Cognition
Lecture types:	Machine Perception and Cognition: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Machine Perception and Cognition: schrP90 - written exam, 90 minutes	
Additional Explanation:	
None	
Recommended prerequisites:	
knowledge in linear algebra and logic, graph representations	
Objectives:	
<p>Upon completion of the module, students will be able to:</p> <ul style="list-style-type: none"> • Understand and analyse image formation in a camera and name the main factors influencing image quality, image sharpness, brightness, resolution and frame rate. • Understand the basics of audio signal processing, feature analysis and audio recognition. • State the basics of digital and analogue camera technology and corresponding transmission methods. • Apply and recognise linear and non-linear filters and convolution operations appropriately. • Extract features (corners, edges and contours) from images, apply threshold operations and determine the properties of regions, edges and contours. • Apply classical and modern machine learning and deep learning algorithms to automate computer vision tasks. • Explain the basics of object recognition and image search, object detection techniques. • Explain the theoretical background of convolutional neural networks and their application for object recognition. • Acquire an overall understanding of the data flow and data quality from signal generation to cognition, independent of the actual field of application. 	
Content:	
<p>Topics will be chosen from contemporary areas of deep machine learning applied to tasks within the context of machine perception and cognition including the following:</p> <ol style="list-style-type: none"> 1 Machine perception <ul style="list-style-type: none"> ○ signal flow from physical signals to electrical signals, sampling, discretization, Nyquist-Shannon-theorem to feature extraction. Examples from electrical engineering, audio analysis and image recognition ○ linear and nonlinear filters ○ one- and two-dimensional fast Fourier-transformation 	

- convolution in one- and two-dimensional data, concept and application
- region morphology
- classification methods (hypercubes/spheres, SVM, KNN)
- 1. Machine cognition
 - foundation of machine cognition
 - discriminative methods of object classification: naive Bayes, neural networks, CNNs
 - implementation of discriminant methods in Python
 - graphical models: Bayes nets, Markov networks
 - semantic segmentation
 - object detection: part based models, region based models

Literature:

Will be specified at the beginning

Mathematics 2 – (with practical course)	
Module abbreviation:	AVE_Math2
Curriculum:	Programmes
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 5
Responsible for module:	Ebert, Bernd Martin
Lecturers:	Ebert, Bernd Martin (AVE_Math2) Hunsinger, Jörg (AVE_ExMath2)
Language of instruction:	English
Credit points / SWS:	6 ECTS / 5 SWS
Workload:	Contact hours: 59 h
	Self-study: 91 h
	Total: 150 h
Subjects of the module:	Mathematics 2: Mathematics 2 Exercise Course Mathematics 2: Exercise Course Mathematics 2
Lecture types:	Mathematics 2: SU - lecture Exercise Course Mathematics 2: Ü - exercise course
Studien- / Prüfungsleistungen:	
Mathematics 2: schrP90 - written exam, 90 minutes Exercise Course Mathematics 2: O - without proof of performance Additional Explanation: None	
Recommended prerequisites:	
Basic calculus: exponentiation, roots, fractions, exponential function, logarithm; Basic differentiation and integration; Transforming and solving of equations and inequations; Basic vector analysis: vector addition, vector products, matrices Mathematics I	
Objectives:	
After successfully completing this module the students shall be able to <ul style="list-style-type: none"> • reliably calculate partial and total derivatives of multivariate real functions and correctly perform important integration methods for multivariate real functions. • analyze the behaviour of multivariate real functions (e.g. extreme values) by using differential calculus. • geometrically analyze multivariate functions with multiple integration. • understand important multivariate integral theorems such as: divergence theorem and Stokes' theorem and apply them in the derivation of the Maxwell equations. • correctly apply important solution methods on simple ordinary differential equations. • understand how ordinary differential equations can be solved numerically. • calculate the Laplace transform and the inverse Laplace transform of given functions and use the Laplace transform to solve ordinary differential equations. 	
Content:	
<ul style="list-style-type: none"> • Differential calculus with more than one variable: scalar functions with two and more variables, potential function, partial derivative, gradient, total differential, implicit derivation, directional derivative • Integral calculus with more than one variable: two- and three-dimensional area integral, polar coordinates, path integral over vector and scalar field, scalar potential and gradient field, path 	

independent integral, spherical coordinates, surface integral over vector and scalar field, flux, divergence theorem with application, vortex field, curl, Stokes' theorem, Nabla operator, Maxwell equations

- Differential equations: ordinary DE, separation of variables, inhomogeneous ODE of n-th order, harmonic vibration, numerical methods to solve ODE (Euler, Runge-Kutta)
- Laplace transform

Literature:

- BIRD, John O., 2014. *Understanding engineering mathematics: [SI units USED]*. London ; New York: Routledge. ISBN 978-0-415-66284-0, 0-415-66284-2
- JAMES, Glyn, Phil P. G. DYKE and John SEARL, 2020. *Modern engineering mathematics*. Harlow, England: Pearson. ISBN 978-1-292-25349-7
- CROFT, Anthony and Robert DAVISON, 2019. *Mathematics for engineers*. Harlow, England: Pearson. ISBN 978-1-292-25364-0

Optimization Methods for Machine Learning - Master	
Module abbreviation:	AI_Opt
Curriculum:	Programmes
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 12
Responsible for module:	Gründinger, Andreas
Lecturers:	Gründinger, Andreas
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Optimization Methods for Machine Learning: Optimization Methods for Machine Learning
Lecture types:	Optimization Methods for Machine Learning: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Optimization Methods for Machine Learning: LN - written exam, 90 minutes	
Additional Explanation:	
None	
Recommended prerequisites:	
None	
Objectives:	
<ul style="list-style-type: none"> • Knowledge of the basics of optimization in theory and practical experiments • Teaching of technical terms and the ability to read relevant literature on the subject of optimization • Solving classical optimization problems in exercises accompanying lectures • Independently classifying optimization approaches and experimenting with different solution approaches in practical experiments • Presenting, recording, and evaluating experimental results • Strengthening communication, coordination and teamwork skills 	
Content:	
<ul style="list-style-type: none"> • Classification and feasibility of optimization problems • Convex functions; linear, affine and convex combinations; convexity preserving transformations • Unrestricted optimization; (sub-)gradient descent algorithms; stochastic gradient descent algorithms; applications in machine learning (backpropagation); regularization methods • Restrictions and convex constraint sets; application in support vector machines • Linear optimization; extremal points of linear sets; simplex method • Nonlinear constrained optimization; gradient projection algorithms • Applications <p>Lab Contents:</p> <ul style="list-style-type: none"> • Matlab and Optimization • Gradient descent methods in machine learning • Linear regression • Interior-point solutions vs. gradient projection approaches 	

Literature:

- BOYD, Stephen P. and Lieven VANDENBERGHE, 2014. *Convex optimization*. 16. edition. Cambridge [u.a.]: Cambridge Univ. Press. ISBN 978-0-521-83378-3
- SRA, Suvrit, Sebastian NOWOZIN and Stephen J. WRIGHT, 2012. *Optimization for machine learning*. Cambridge, Mass.: MIT Press. ISBN 978-0-262-29877-3, 0-262-29877-5

Planning and Decision-Making Algorithms	
Module abbreviation:	AVE_PDMA
Curriculum:	Programmes
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 23
Responsible for module:	Hagerer, Andreas
Lecturers:	Hagerer, Andreas
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Planning and Decision-Making Algorithms: Planning and Decision-Making Algorithms
Lecture types:	Planning and Decision-Making Algorithms: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Planning and Decision-Making Algorithms: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
Foundations of Machine Learning Algorithms and Data Structures	
Objectives:	
After successfully completing this module the students shall be able to <ul style="list-style-type: none"> • understand the basic principles of planning and decision making. • assess and choose appropriate algorithms for a given problem. • implement basic planning and decision making algorithms. • model domains as Markov decision processes. • apply Monte Carlo and temporal difference methods. 	
Content:	
<ol style="list-style-type: none"> 1 Introduction to Planning and Decision-Making <ul style="list-style-type: none"> ○ What is planning? What is decision-making? ○ Everyday examples (e.g., navigation apps, robot vacuums, game AI) 2. Problem Formulation <ul style="list-style-type: none"> ○ State-space representation ○ Defining the goal (cost functions, constraints, optimal vs. feasible solutions) 3. Classical Planning Algorithms <ul style="list-style-type: none"> ○ Graph Search Methods 4. Probabilistic Planning and Heuristics <ul style="list-style-type: none"> ○ Monte Carlo methods ○ Sampling-based planning 5. Decision-Making Under Uncertainty <ul style="list-style-type: none"> ○ Markov Decision Processes (MDPs) 	

○ Basics of Reinforcement Learning

Literature:

- LAVALLE, Steven Michael, 2006. *Planning algorithms* [online]. Cambridge: Cambridge University Press PDF e-Book. ISBN 978-0-511-54687-7. Available via: <https://doi.org/10.1017/CBO9780511546877>.
- EDELKAMP, Stefan and Stefan SCHRÖDL, © 2012. *Heuristic search: theory and applications*. Amsterdam: Elsevier/Morgan Kaufmann. ISBN 978-0-12-372512-7, 0-12-372512-7
- SUTTON, Richard S. and Andrew BARTO, 2020. *Reinforcement learning: an introduction*. Cambridge, Massachusetts ; London, England: The MIT Press.
- LAPAN, Maxim, January 2020. *Deep reinforcement learning hands-on: apply modern RL methods to practical problems of chatbots, robotics, discrete optimization, web automation, and more*. Birmingham ; Mumbai: Packt. ISBN 978-1-83882-004-6

Sensor Data Processing and Sensor Data Fusion (with practical course)	
Module abbreviation:	AVE_SDPF
Curriculum:	Programmes
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 22
Responsible for module:	Kefferpütz, Klaus
Lecturers:	Kefferpütz, Klaus (AVE_SDPF) Zieher, Simon (AVE_PractSDPF)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	Sensor Data Processing and Sensor Data Fusion: Sensor Data Processing and Sensor Data Fusion Practical Course Sensor Data Processing and Sensor Data Fusion: Practical Course Sensor Data Processing and Sensor Data Fusion
Lecture types:	Sensor Data Processing and Sensor Data Fusion: SU/Ü - lecture with integrated exercises Practical Course Sensor Data Processing and Sensor Data Fusion: Pr - laboratory
Studien- / Prüfungsleistungen:	
Sensor Data Processing and Sensor Data Fusion: schrP90 - written exam, 90 minutes Practical Course Sensor Data Processing and Sensor Data Fusion: LN - participation without/with success Additional Explanation: Prerequisite for participation in the written examination is a successfully completed practical course.	
Recommended prerequisites:	
Mathematics I + II Digital Signal Processing Programming I + II Electronics, Signals, and Measurements Control Engineering	
Objectives:	
After successfully completing this module the students shall be able to <ul style="list-style-type: none"> • understand the fundamental principles in estimation and detection theory. • implement algorithms for parameter estimation in linear and nonlinear models and for detection and estimation of the position of a target in a sensor network. • apply the Kalman filter to linear state space models with a multitude of sensors. • apply nonlinear filters (extended Kalman filter, unscented Kalman filter, particle filter) to nonlinear or non-Gaussian state space models. • implement basic algorithms for simultaneous localization and mapping (SLAM). • describe and model the most common sensors used in sensor fusion applications. • implement the most common motion models in target tracking and navigation applications. • understand the interplay of the above in a few concrete real applications. 	
Content:	
<ul style="list-style-type: none"> • Estimation theory for linear and nonlinear models 	

- Cramér-Rao lower bound (CRLB). Models for sensor network applications
- Detection and Filter theory
- Modeling and motion models
- Kalman filter. Kalman filter approximations for nonlinear models (EKF, UKF)
- The point-mass filter and the particle filter
- The particle filter theory
- The marginalized particle filter
- Simultaneous localization and mapping (SLAM)
- Sensors and sensor-near signal processing. Filter and model validation

Literature:

- GUSTAFSSON, Fredrik, 2018. *Statistical sensor fusion*. Lund: Studentlitteratur. ISBN 978-91-44-12724-8, 91-44-12724-3
- MITCHELL, Harvey B., 2007. *Multi-sensor data fusion: an introduction* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-1-61583-489-1, 978-3-540-71463-7. Available via: <https://doi.org/10.1007/978-3-540-71559-7>.
- GIBBS, Bruce. P., © 2011. *Advanced kalman filtering, least-squares and modeling: a practical handbook* [online]. Hoboken, N.J.: Wiley PDF e-Book. ISBN 978-0-470-89003-5, 0-470-89003-7. Available via: <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470890042>.

Testing and Simulation Methods for Vehicle Safety - Master	
Module abbreviation:	IAE_TSMS
Curriculum:	Programmes
	International Automotive Engineering (IAE-M) - SPO-Nr.: 13
Responsible for module:	Vaculin, Ondrej
Lecturers:	Vaculin, Ondrej
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Testing and Simulation Methods for Vehicle Safety: Testing and Simulation Methods for Vehicle Safety
Lecture types:	Testing and Simulation Methods for Vehicle Safety: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Testing and Simulation Methods for Vehicle Safety: schrP90 - written exam, 90 minutes	
Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After successfully completing the master's thesis, students are able to</p> <ul style="list-style-type: none"> • know how to test automotive safety systems and control units while its development process. • understand different testing methods and their usage for different types of control units and different criticalities. • know when and how to use simulation as an improvement of the testing process, which types of simulation can be used and their pros and cons. 	
Content:	
<ul style="list-style-type: none"> • vehicle approval process, consumer testing • testing as part of the development process (ISO 26262/ V-model) • testing methods and testing metrics <ul style="list-style-type: none"> ○ electrical safety ○ passive safety ○ active safety ○ automated driving • application of simulation-based methods • components of simulation • different model types 	
Literature:	
<ul style="list-style-type: none"> • ARJUNRAJ, P., 2024. <i>Functional Safety in Modern Mobility: ISO 26262 and Beyond: ISO 26262 and Beyond</i>. ISBN 979-8894753379 • THE ART SERVICE, 2020. <i>ISO 26262 A Complete Guide</i>. ISBN 978-1867441762 	

- SOKOLOVSKIJ, Edgar, ŽURĀULIS, Vidas, 2024. *Advances in vehicle dynamics and road safety: technologies, simulations and applications* [online]. Basel: MDPI PDF e-Book. ISBN 978-3-7258-1182-3. Available via: <https://doi.org/10.3390/books978-3-7258-1182-3>.

Vehicle Actuators	
Module abbreviation:	AVE_VehAct
Curriculum:	Programmes
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 24
Responsible for module:	Birkner, Christian
Lecturers:	Birkner, Christian; Tolksdorf, Leon
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Vehicle Actuators: Vehicle Actuators
Lecture types:	Vehicle Actuators: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Vehicle Actuators: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
Foundations of Engineering Sciences Vehicle Dynamics Modelling and Simulation	
Objectives:	
<p>After successfully completing this module the students shall be able to</p> <ul style="list-style-type: none"> question and classify the functionality and operating principles of specific mechatronic systems. develop independent interpretations for mechatronic systems and evaluate them in a targeted manner. gain a well-founded understanding of important sensors for AD-related mechatronics and describe them in technical detail. conceive and design mechatronic components of automated vehicle systems and assign these systems to the assemblies and functional units of a vehicle and describe their requirements. know the basics of electrical systems, vehicle bodies, drive machines, braking systems, steering systems. explain the powertrain in the vehicle and demonstrate the interaction in the overall network and compare powertrains in terms of design and functionality and their control strategies. 	
Content:	
<ul style="list-style-type: none"> Modeling and description of mechatronic systems and identification of the essential components Mathematical and functional modes of action of important sensors in automated driving and their properties (resolution, linearity, transfer functions, system identification) Essential actuators of mechatronic systems (electrical, piezoelectric drives) Function chain description of mechanical variables via electrical detection and circuitry Basics of data interpretation of mechatronic system states Mechatronic components of automated driving functions with steering, chassis and motor 	
Literature:	
<ul style="list-style-type: none"> JOUANEH, Musa, 2013. <i>Fundamentals of mechatronics</i>. Stamford, Conn.: Cengage Learning. ISBN 978-1-111-56902-0 	

- SCHRAMM, Dieter, HILLER, Manfred, BARDINI, Roberto, 2018. *Vehicle Dynamics: Modeling and Simulation* [online]. Berlin, Heidelberg: Springer Berlin Heidelberg PDF e-Book. ISBN 978-3-662-54483-9. Available via: <https://doi.org/10.1007/978-3-662-54483-9>.
- BOLTON, William, 2019. *Mechatronics: electronic control systems in mechanical and electrical engineering*. Harlow, England: Pearson. ISBN 978-1-292-25100-4

Vehicle Dynamics - Master	
Module abbreviation:	IAE_VDS
Curriculum:	Programmes
	International Automotive Engineering (IAE-M) - SPO-Nr.: 6
Responsible for module:	Arnold, Armin
Lecturers:	Arnold, Armin
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Vehicle Dynamics: Vehicle Dynamics
Lecture types:	Vehicle Dynamics: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Vehicle Dynamics: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
ability to apply the physical rules of mechanical systems, especially Newton's laws; basic knowledge of electrics/electronics	
Objectives:	
After successfully completing the master's thesis, students are able to <ul style="list-style-type: none"> • explain and judge all tire properties that are important for vehicle dynamics. • calculate according to some simplified vehicle models. • analyse how drivetrain, brakes and other chassis components work together, e.g. like control arms, spring rates, position of center of gravity, differentials including limited slip differentials, torque-vectoring-differentials. • explain the operational principles of ABS-control. • explain vehicle stability control systems. • deduct the additional possibilities given by four-wheel-steering, torque-vectoring and active suspensions. 	
Content:	
<ul style="list-style-type: none"> • tire and tire properties under different conditions (camber, normal force, combinations of longitudinal and/or lateral slip) • Kamm's circle and its application to different scenarios • properties of rubber and brush model of tire • vehicle models (single track model steady state and dynamically, application to cornering, banked road, sidewind, physical and effective sideslip stiffness) • influencing driving behaviour by means of suspension: <ul style="list-style-type: none"> ○ roll- und instant center, (elasto)-kinematics ○ spring stiffnesses ○ distribution of driving- and braking torques • drive train influences: behavior of open differentials, limited slip differentials (viscous and clutch type, 4WD) • ABS algorithm 	

- traction control and vehicle stability control
- torque vectoring

Literature:

- REIMPELL, Jörnsten, Jürgen W. BETZLER and Helmut STOLL, 2001. *The automotive chassis: engineering principles: chassis and vehicle overall, wheel suspensions and types of drive, axle kinematics and elastokinematics, steering - springing - tyres, construction and calculations advice*. Oxford [u.a.]: Butterworth-Heinemann. ISBN 0-7506-5054-0
- MILLIKEN, William F. and Douglas L. MILLIKEN, 1995. *Race car vehicle dynamics*. Warrendale, PA: SAE International. ISBN 1-56091-526-9, 978-1-56091-526-3
- GENTA, Giancarlo and Lorenzo MORELLO, . *The automotive chassis*. [Dordrecht]: Springer Netherland.
- HANEY, Paul, 2012. *The racing & high-performance tire: using the tires to tune for grip and balance*. Dallas, Tex. [u.a.]: InfoTire [u.a.]. ISBN 0-9646414-2-9, 978-0-7680-12415

Vehicle-to-X-Communication	
Module abbreviation:	AVE_V2X
Curriculum:	Programmes
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 20
Responsible for module:	Festag, Andreas
Lecturers:	Festag, Andreas
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Vehicle-to-X-Communication: Vehicle-to-X-Communication
Lecture types:	Vehicle-to-X-Communication: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Vehicle-to-X-Communication: schrP90 - written exam, 90 minutes	
Additional Explanation:	
None	
Recommended prerequisites:	
Foundations of Engineering Sciences	
Vehicle Electronics and Vehicle Communication Networks	
Objectives:	
After successfully completing this module the students shall be able to	
<ul style="list-style-type: none"> • understand the layered design of communication networks. • explain the principles and application of protocols in communication networks for reliable communication, media access, routing and transport control. • describe the application, use cases and requirements for Vehicle-to-X communication networks. • describe the architectures and communication technologies for Vehicle-to-X communication. • understand the advantages and disadvantages of existing Vehicle-to-X systems. • evaluate current and future proposals of architectures for Vehicle-to-X communication networks. 	
Content:	
<ul style="list-style-type: none"> • The mobile radio channel, digital modulation schemes (e.g., PSK, QAM) and OFDM signalling • Channel capacity, error correction and detection • Reliable communication over error prone channels using ARQ schemes (e.g., stop-and-wait, go-back-N, selective repeat) • Media access of wireless channels (ALOHA, CSMA with collision detection and avoidance) • Examples of wireless communication systems, 5G-cellular and WiFi Vehicle-to-X communication systems • IP mobility support, ad hoc networking and congestion control for Vehicle-to-X • Vehicle-to-X data security, anonymity and standardisation • Vehicle-to-X use cases and applications (e.g., sensor data sharing, maneuver coordination) • Future developments and outlook 	
Literature:	
<ul style="list-style-type: none"> • KUROSE, James F. and Keith W. ROSS, 2022. <i>Computer networking: a top-down approach</i>. Harlow: Pearson. ISBN 978-1-292-40546-9, 1-292-40546-5 	

- TANENBAUM, Andrew S., Nick FEAMSTER and David WETHERALL, 2021. *Computer networks*. Harlow: Pearson. ISBN 978-1-292-37406-2
- SOMMER, Christoph and Falko DRESSLER, 2015. *Vehicular networking*. Cambridge: Cambridge Univ. Press. ISBN 978-1-107-04671-9
- CAMPOLO, Claudia, 2015. *Vehicular ad hoc networks: standards, solutions, and research* [online]. Cham [u.a.]: Springer PDF e-Book. ISBN 978-3-319-15497-8, 978-3-319-15496-1. Available via: <https://doi.org/10.1007/978-3-319-15497-8>.

Verification of Machine-Learning Algorithms - Master	
Module abbreviation:	AI_VerMLAlgo
Curriculum:	Programmes
	AI Engineering of Autonomous Systems (AI-M)
Responsible for module:	Giesler, Björn
Lecturers:	Giesler, Björn
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	Verification of Machine-Learning Algorithms: Verification of Machine-Learning Algorithms
Lecture types:	Verification of Machine-Learning Algorithms: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
Verification of Machine-Learning Algorithms: LN - oral exam, 20 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Upon completion of the module, students will be able to:</p> <ul style="list-style-type: none"> • Distinguish between verification and validation of machine-learning (ML) systems. • Understand the risks and consequences of false decisions by ML algorithms. • Apply classical and contemporary verification techniques to ML models. • Reflect critically on the societal and ethical ramifications of ML errors. 	
Content:	
<ul style="list-style-type: none"> • Introduction to ML Verification: The “black-box” nature of modern ML, correctness, robustness, interpretability • Motivation and Challenges: Lack of formal specifications • Verification vs. Validation: Definitions and examples, Role of statistical evaluation vs. formal guarantees • False Decisions in ML Systems: Taxonomy of failures, Root causes: bias in data, model brittleness, distributional drift • Techniques for Verifying Correctness: Probe points, Large-scale phenomenological testing • Classical formal methods applied to ML (symbolic execution, model checking, SMT solvers), • Societal and Ethical Implications: Accountability in algorithmic decisions, fairness, transparency, and justice 	
Literature:	
Will be specified at the beginning	



Course Descriptions

Computer Science

International Office

Summer term 2026

As per: 2026-02-10

This program and course description becomes effective on 15.03.2026. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations.

Artificial Intelligence (Master)

Subject	SWS	ECTS
Social Implications of Artificial Intelligence	4	5

Informatik Bachelor (IB)

Subject	SWS	ECTS
Cryptology	4	5
eTHics_basic	4	5
Selected Topics of Operations Research	4	5

Computer Science and Artificial Intelligence (CAI)

Subject	SWS	ECTS
Algorithms for AI 1	6	7
Practical Course Algorithms for AI 1	2	0
Algorithms for AI 3	6	7
Practical Course Algorithms for AI 3	2	0
Business Administration and Entrepreneurship	4	5
Computer Vision	6	7
Practical Course Computer Vision	2	0
Cyber Security	6	7
Practical Course Cyber Security	2	0
Database Systems and Big Data Technologies	6	7
Practical Course Database Systems and Big Data Technologies	2	0
Human-Computer Interaction and Explainable AI	6	7
Practical Course Human Computer Interaction and Big Data Technologies	2	0
Introduction to Computer Science 2	4	7
Mathematics 2	4	7
Programming 2	6	7
Practical Course Programming 2	2	0
Project Management	4	5
Scientific Research Methods	2	2
Spoken and Natural Language Understanding	6	7
Practical Course Spoken and Natural Language Understanding	2	0
Web Technologies	6	7
Practical Course Web Technologies	2	0

Cyber Security (CSI)

Subject	SWS	ECTS
Specialised Seminar	2	3
Secure Systems	4	5

Sociotechnical Cybersecurity (Master)(SOC)

Subject	SWS	ECTS
Information and Product Security Management and Communication	4	6

User Experience Design UXDM (Master)

Subject	SWS	ECTS
Agile Project Management	2	3
Multimodal, Interactive Systems	5	6
Exercises in Programming for Multimodal, Interactive Systems	2	0
Programming for Multimodal, Interactive Systems	3	0
Research Methods in HCI	4	5

Agile Project Management - Master	
Module abbreviation:	UXDM_APM
Curriculum:	Programmes
	User Experience Design (Master) (UXD-M) - SPO-Nr.: 5
Responsible for module:	Märtens, Holger
Lecturers:	Märtens, Holger
Language of instruction:	English
Credit points / SWS:	3 ECTS / 2 SWS
Workload:	Contact hours: 23 h
	Self-study: 52 h
	Total: 75 h
Subjects of the module:Re	5: Agile Project Management
Lecture types:	5: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
5: schrP90 - written exam, 90 minutes	
Additional Explanation:	
None	
Recommended prerequisites:	
None	
Objectives:	
<p>After active participation in the course, students</p> <ul style="list-style-type: none"> • ...are able to understand and explain the most important methods of agile project management • ...have acquired the competence to apply agile project management methods in companies, start-ups and scientific institutions • ...have acquired extensive knowledge to manage complex projects by consistently focusing on creating customer value • ...have acquired the ability to apply Kanban and scrum methodologies in order to catalyze cultural change and deliver better business agility • ...are able to identify the appropriate environment for the application of agile methods • ...have acquired the knowledge to outline a hybrid project scenario and subsequently realize it • ...can describe in detail how agile methods can be applied to large projects • ...are able to list the reasons for the failure of agile projects and understand the causes for it <p>Self- and social competences:</p> <p>Upon completion of the module, students</p> <ul style="list-style-type: none"> • ...are able to think agile and can take responsibility in an agile team • ...have good communication skills in critical project situations • ...have learned to work openly with each other and to communicate transparently • ...have learned to consider failures as a basis for improvement 	
Content:	
<ul style="list-style-type: none"> • Foundations: Brief summary of traditional project management; Cynefin Framework; the agile manifesto and principles; Stacey Matrix • Scrum: Values; events; roles; artifacts; additional elements • Kanban 	

- Lean thinking: Lean principles; Lean startup, MVP
- Other agile methods: Extreme programming; PDCA; Continuous Improvement; TDD; BDDe
- Hybrid approaches
- Agile approaches for large projects/programs: Nexus; LeSS; SAFe
- Reason for failure in agile: Anti-patterns

Literature:

- FLEWELLING, Paul, 2018. *The Agile developer's handbook: get more value from your software development : get the best out of the Agile methodology*. Birmingham, UK: Packt Publishing. ISBN 978-1-78728-073-1, 1-78728-073-X
- SUTHERLAND, Jeff, 2019. *SCRUM: the art of doing twice the work in half the time*. London: Random House Business. ISBN 978-1-847-94110-7
- KNIBERG, Henrik and Mattias SKARIN, 2010. *Kanban and Scrum: making the most of both*. s. l.: C4Media Inc.. ISBN 978-0-557-13832-6
- ANDERSON, David J., 2010. *Kanban: successful evolutionary change for your technology business*. Sequim, Wash.: Blue Hole Press. ISBN 978-0-9845214-0-1
- RIES, Eric, 2020. *The lean startup: how today's entrepreneurs use continuous innovation to create radically successful businesses*. New York: Redline Verlag. ISBN 978-3-86881-567-2
- OLSEN, Dan, 2015. *The lean product playbook: how to innovate with minimum viable products and rapid customer feedback* [online]. Hoboken: Wiley PDF e-Book. ISBN 978-1-118-96102-5, 1-118-96102-1. Available via: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119154822>.
- CHRISTENSEN, Clayton M., 2016. *The innovator's dilemma: when new technologies cause great firms to fail*. Boston, Massachusetts: Harvard Business Review Press. ISBN 978-1-4221-9602-1, 978-1-63369-178-0
- LEOPOLD, Klaus, 2017. *Practical Kanban: From team focus to creating value*. Vienna, Austria: LEANability Press.

Algorithms for AI 1 (with practical course)	
Module abbreviation:	CAI_AAI1
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 9
Responsible for module:	Nagel, Christian
Lecturers:	Nagel, Christian (CAI_AAI1) Nagel, Christian (CAI_AAI1Pr)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	9.1: Algorithms for AI 1 9.2: Practical Course Algorithms for AI 1
Lecture types:	9.1: SU/Ü - lecture with integrated exercises 9.2: Pr - laboratory
Studien- / Prüfungsleistungen:	
9.1: schrP90 - written exam, 90 minutes 9.2: LN - participation without/with success Additional Explanation: A prerequisite for participation in the written examination is a successfully completed practical course (see SPO No. 9.2). Students must successfully complete and submit at least 7 exercise sheets. Students must successfully complete and submit at least 7 exercise sheets.	
Recommended prerequisites:	
None	
Objectives:	
<p>In this learning module, basic algorithms of statistics-based artificial intelligence and their applications are explained. Students will learn the basic principles of machine learning using methods from supervised and unsupervised. The module will illustrate the fundamental ideas of learning patterns from data and how to use these models for predicting unseen data. Further, the theoretical knowledge will be applied to real world problems in practical exercises. After successfully attending this module, students know and understand the basic principles of learning systems and their applications to real world problems. They know</p> <ul style="list-style-type: none"> • the general idea of learning from data by optimizing. • different methods to learn from data: Supervised and Unsupervised Learning. • the mathematical basis and the most important algorithms to train machine learning models on their own. • how to preprocess data. • how to construct and monitor a machine learning training procedure. • how to evaluate and validate machine learning models using different loss functions. • the basic pitfalls and problems when training models and how to solve them efficiently. 	
Content:	
<ul style="list-style-type: none"> • Logic and Fuzzy Logic • Basic concepts of Machine Learning • Preprocessing 	

- Supervised Learning
 - Regression
 - Classification
 - Gradient Descent
- Data preparation and preprocessing
- Evaluation and Validation
- Loss Functions
- Unsupervised Learning
- Frameworks and Tools
- Practical applications of modern machine learning algorithms

Literature:

- GOODFELLOW, Ian, Yoshua BENGIO and Aaron COURVILLE, 2016. *Deep learning*. Cambridge, Massachusetts ; London, England: The MIT Press. ISBN 978-0-262-33737-3
- BISHOP, Christopher M., 2016. *Pattern recognition and machine learning*. softcover reprint of the original 1st edition 2006. edition. New York, NY: Springer. ISBN 978-1-4939-3843-8
- RUSSEL, and NORVIG, 2022. *Artificial Intelligence - A Modern Approach*. ISBN 978-1-292-40113-3

Algorithms for AI 3 (with practical course)	
Module abbreviation:	CAI_AA13
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 9
Responsible for module:	Hahndel, Stefan
Lecturers:	Hahndel, Stefan; Jäger, Rudolf (CAI_AA13) Hahndel, Stefan; Jäger, Rudolf (CAI_AA13Pr)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	19.1: Algorithms for AI 3 19.2: Practical Course Algorithms for AI 3
Lecture types:	19.1: SU/Ü - lecture with integrated exercises (CAI_AA13) 19.2: Pr - laboratory (CAI_AA13Pr)
Studien- / Prüfungsleistungen:	
<p>19.1: schrP90 - written exam, 90 minutes 19.2: LN - participation without/with success</p> <p>Additional Explanation:</p> <p>A prerequisite for participation in the written examination is a successfully completed practical course (see SPO-No. 19.2).</p> <p>Several test certificates (programming tasks) must be obtained as part of the practical course. If the tasks are successfully completed, the lecturer will award a certificate for each task.</p> <p>A total of six tasks must be completed, which deal with essential topics of the lecture. The completed solutions must be presented individually, and questions about the solution concept and the program created must be answered.</p> <p>Only if all six compulsory tasks are presented on time will the certificate of achievement be deemed to have been achieved.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>This module completes the trilogy of AI algorithms. After the basics and techniques of statistical/stochastic AI have been introduced and learned in the first two modules, this module supplements the holistic overview with selected, practice-relevant application areas of machine learning methods, with approaches of distributed AI and with the most important concepts and methods of symbolic AI.</p> <p>After successfully completing this module, the students:</p> <ul style="list-style-type: none"> • can reflect the purpose and background of selected machine learning applications that are frequently used in practice. • understand that distributed AI allows not to join the necessary huge amounts of data at a central site, but to analyze the data directly at the source. • are proficient in some concepts and techniques of symbolic AI, where the solution strategy is not learned from sample data but is based on knowledge that is represented symbolically. Such methods are used when no data is available for the learning process or when the task can be represented in terms of logical relationships. 	

- are able to formally represent knowledge using appropriate models and languages
- have practical experience in applying formal knowledge models within knowledge-based systems. This objective involves the use of formal knowledge representation techniques to design and implement systems capable of intelligent behavior, such as expert systems and automated reasoning systems.

The practical course accompanying the course "Algorithms for AI 3" serves to teach and train the students to put into practice the knowledge they have acquired in the lecture. In addition, to preparatory exercises, the students must independently solve six programming tasks of increasing complexity during the semester and write executable programs. The finished programs are presented to the respective lecturer and thus also serve as proof of performance for admission to the examination.

Content:

- Selected, practice-relevant application areas of machine learning methods
 - Recommender Systems
 - Fraud Detection (banking, financial services)
 - Biometric Recognition
 - Sentiment Analysis
- Distributed AI
 - Multi-agent Systems
 - Swarm Intelligence
- Concepts and Methods of Symbolic AI
 - Logic Programming (Prolog)
 - Graph problem solving: application to game problems
 - Machine Reasoning
 - Constraint Satisfaction Problems and Constraint Logic Programming
 - Knowledge representation: logic, inference, rule-based systems and expert systems

Practical Course:

- Machine Learning
- Search Algorithms
- Logic / Prolog
- Constraint Satisfaction Problems

Literature:

- RUSSEL, Stuart J. and Peter NORVIG, 2016. . ISBN 978-1292153964
- BRAMER, Max, 2013. *Logic Programming with Prolog*. ISBN 978-1447154860
- RUSSEL, and NORVIG, . .

Business Administration and Entrepreneurship	
Module abbreviation:	CAI_BAEnt
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 23
Responsible for module:	Djanatliev, Anatoli
Lecturers:	Guist, Mark
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	23: Business Administration and Entrepreneurship
Lecture types:	SU/Ü - lecture with integrated exercises (CAI_BAEnt)
Studien- / Prüfungsleistungen:	
23: LN - seminar paper (10-15 pages) and oral presentation (15-30 minutes)	
Additional Explanation:	
None	
Recommended prerequisites:	
None	
Objectives:	
<p>After successful participation in this module, students</p> <ul style="list-style-type: none"> • have an overview of the object of study, approaches and differentiation of business administration. • have acquired the ability to understand companies as carriers of economic activity from the perspective of value-oriented thinking and acting. • have the ability to comprehend constitutive decisions and to assess the application purposes of different legal forms. • can describe the essential characteristics of corporate responsibility and leadership. • are able to describe and explain fundamental areas of a company (e.g. materials management, production management, marketing and sales, investment and financing) both internally and externally using operational goals, functions and processes. • are able to describe the essential characteristics and procedures in innovation management. • understand the essential aspects of entrepreneurship and are able to apply them in a practical context. 	
Content:	
<ul style="list-style-type: none"> • Basic concepts of business administration • Constitutive decisions • Leadership and management • Materials and production management • Marketing and sales • Investment management • Innovation management • Entrepreneurship <ul style="list-style-type: none"> ○ Generating Business Ideas ○ Business Models 	

- Case Studies and Practical Examples (TOPSIM)

Literature:

Will be specified at the beginning

Computer Vision (with practical course)	
Module abbreviation:	CAI_CVis
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 18
Responsible for module:	Schön, Torsten
Lecturers:	Schön, Torsten (CAI_CVis) Thirugnana Sambandham, Venkatesh (CAI_CVisPr)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	18.1: Computer Vision 18.2: Practical Course Computer Vision
Lecture types:	18.1: SU/Ü - lecture with integrated exercises (CAI_CVis) 18.2: Pr - laboratory (CAI_CVisPr)
Studien- / Prüfungsleistungen:	
<p>18.1: schrP90 - written exam, 90 minutes 18.2: LN - participation without/with success</p> <p>Additional Explanation:</p> <p>A prerequisite for participation in the written examination is a successfully completed practical course (see SPO-No. 18.2).</p> <p>In the practical course, the contents of the lecture are deepened by means of practical tasks. In order to obtain the admission requirement for participation in the final and graded written examination, a semester-long practical course must be passed "with success". Successful completion of the accompanying practical course is a prerequisite for participation in the examination. To receive the certificate of achievement, a project must be worked on and submitted. The project results must be summarized in a written report and presented in a short presentation. The task set in the project as well as the presentation will be evaluated by the lecturer. On the basis of this evaluation, admission for participation in the final and graded written examination will be decided.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>In the module students learn the theoretical basics and the application of classical as well as modern image processing algorithms. After successful participation they are able to:</p> <ul style="list-style-type: none"> • describe how image data are created and how they are represented on a computer. • to implement basic algorithms of image manipulation independently. • classify images with the help of Deep Learning. • recognize and classify objects in images with the help of Deep Learning. • segment images semantically in an automated way. • validate and correctly interpret results from Deep Learning networks. • work with relevant computer vision frameworks (e.g. OpenCV, PyTorch, Tensorflow). • Correctly use, understand, and independently apply modern network architectures for various image processing applications (e.g., Human Pose Estimation, GANs, Attention Mechanism). 	

Content:

Understanding of image data and their representation in modern computer systems

- Classic image processing
 - Transformations
 - Image manipulations
 - Feature generation (edge detection, histograms, templates, textures)
- Modern image processing
 - Fundamentals of Deep Learning
 - Convolutional Neural Networks
 - Classification
 - Pre-processing (augmentation, normalization, ...)
 - Object Detection
 - Semantic segmentation
 - Instance segmentation
 - Image registration
 - Evaluation of trained models and loss functions
 - Parameterization and initialization of DNNs
 - Adversarial Networks
 - Frameworks (PyTorch, Tensorflow, Keras)

Students learn and practice the practical use of classical and modern algorithms of image processing. They independently implement simple algorithms and train state-of-the-art Deep Learning models using OpenSource frameworks on the basis of practical examples.

Literature:

- GOODFELLOW, Ian, Yoshua BENGIO and Aaron COURVILLE, . *Deep Learning*.

Cryptology	
Module abbreviation:	IB_CRYL
Curriculum:	Programmes
	Cybersicherheit (CSI-B) - SPO-Nr.: 29
Responsible for module:	Roegner, Katherine
Lecturers:	Roegner, Katherine
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	29: Cryptology
Lecture types:	29: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
29: LN - presentation (15-30 min.) and written composition (10-15 pages)	
Additional Explanation:	
None	
Recommended prerequisites:	
None	
Objectives:	
<p>After successfully completing this course, the student will be able to</p> <ul style="list-style-type: none"> state the goals of cryptography. describe common encryption methods und illustrate these methods using concrete examples. discuss strengths and weaknesses of the different encryption methods. identify methods that are suitable for a given situation. explain the mathematical background of specific coding and decoding procedures. describe and illustrate algorithms (for example for generating prime numbers or solving the discrete logarithm problem) using specific numerical examples 	
Content:	
<ul style="list-style-type: none"> basic knowledge from computational number theory such as implementing the Euclidean algorithm or the square and multiply algorithm algebraic structures related to cryptographic methods (finite fields, elliptic curves) and related mathematical questions (such as the discrete logarithm problem) public-key encryption and digital signatures zero-knowledge protocols symmetric-key encryption methods (such as shift registers, pseudo random numbers, DES, IDEA, AES, etc.) 	
Literature:	
<ul style="list-style-type: none"> PAAR, Christof, PELZL, Jan, GÜNEYSU, Tim, 2024. <i>Understanding cryptography: from established symmetric and asymmetric ciphers to post-quantum algorithms</i> [online]. Berlin, Heidelberg: Springer Berlin Heidelberg PDF e-Book. ISBN 978-3-662-69007-9. Available via: https://doi.org/10.1007/978-3-662-69007-9. 	

- HOFFSTEIN, Jeffrey, PIPHER, Jill, SILVERMAN, Joseph H., 2014. *An introduction to mathematical cryptography* [online]. New York, NY [u.a.]: Springer PDF e-Book. ISBN 978-1-4939-1710-5, 978-1-4939-1711-2. Available via: <https://doi.org/10.1007/978-1-4939-1711-2>.
- DELFS, Hans, KNEBL, Helmut, 2015. *Introduction to Cryptography: Principles and Applications* [online]. Berlin ; Heidelberg: Springer PDF e-Book. ISBN 978-3-662-47974-2. Available via: <https://doi.org/10.1007/978-3-662-47974-2>.

Cyber Security (with practical course)	
Module abbreviation:	CAI_CySec
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 21
Responsible for module:	Eggendorfer, Tobias
Lecturers:	Eggendorfer, Tobias (CAI_CySec) Spieß, Paul (CAI_CySecPr)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	21.1: Cyber Security 21.2: Practical Course Cyber Security
Lecture types:	21.1: SU/Ü - lecture with integrated exercises 21.2: Pr - laboratory
Studien- / Prüfungsleistungen:	
<p>21.1: schrP90 - written exam, 90 minutes 21.2: LN - participation without/with success</p> <p>Additional Explanation:</p> <p>A prerequisite for participation in the written examination is a successfully completed practical course (see SPO No. 21.2). The credit certificates to be acquired in the practical course encompass several tasks which must be completed successfully:</p> <ul style="list-style-type: none"> • common security tools • Security programming in Python • Threat and risk analysis • source code analysis • penetration testing <p>The solutions of the tasks can and should be worked out in small groups to promote social and professional competence. The finished solutions are to be processed individually within a fixed schedule. The tasks, the schedule, and the way the results are presented (uploading to Moodle, presentation of the results, ...) will be announced at the beginning of the lecture.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>After attending this module...</p> <ul style="list-style-type: none"> • students know current threats for IT systems and applications, essential security risks, and are able to evaluate and estimate the risk potential for their own projects using a risk analysis. • students know the basic building blocks and principles for building secure systems and applications, e.g. encryption, authentication procedures, public key infrastructures. • students can design a suitable IT security strategy based on a risk analysis, taking into account both organizational and technical aspects and assessing their effectiveness in practice. • students know different attacks on methods of artificial intelligence and can avoid them. 	

- students know different areas of application for artificial intelligence in IT security (e.g. intrusion detection).

Content:

- Threats to IT systems and applications
- Building blocks for IT security
 - cryptography (symmetric and asymmetric encryption, hash functions, signature, key exchange)
 - public key infrastructures
- Secure systems
 - authentication
 - access control
 - hardening of systems
 - trusted execution
 - isolation, ...
- Network security (IPSec, TLS, IEEE 802.1x, RADIUS, firewalls, ...)
- Security principles (Defense in Depth, Least Privilege, Zero Trust, ...)
- Software-related vulnerabilities and how to avoid them
 - Secure software development, SDLC
 - Typical vulnerabilities such as buffer and heap overflows
- Information security management
 - security models and security policies
 - Risk analysis of IT structure and IT-supported business processes
- Threats specific to artificial intelligence and how to avoid them
- Methods of artificial intelligence in IT security (e.g. intrusion detection, malware detection, ...)

Literature:

- ANDERSON, Ross, 2021. *Security Engineering: A Guide to Build Dependable Distributed Systems*. ISBN 978-1119642787
- AUMASSON, Jean-Philippe, . *Serious Cryptography - A Practical Introduction to Modern Encryption* . ISBN 9781593278267
- DEOGUN, Daniel, 2019. *Secure By Design*. ISBN 978-1617294358
- TARANDACH, Izar and Matthew J. COLES, . *Threat Modeling: A Practical Guide for Development Teams*. ISBN 978-1492056553
- PARISI, Alessandro, . *Hands-On Artificial Intelligence for Cyberscurity*. ISBN 978-1789804027

Database Systems and Big Data Technologies (with practical course)	
Module abbreviation:	CAI_DBBD
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 21
Responsible for module:	Cato, Patrick
Lecturers:	Cato, Patrick; Mondal, Rahul (CAI_DBBD) Mondal, Rahul (CAI_DBBDPr)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	16.1: Database Systems and Big Data Technologies 16.2: Practical Course Database Systems and Big Data Technologies
Lecture types:	16.1: SU/Ü - lecture with integrated exercises 16.2: Pr - laboratory
Studien- / Prüfungsleistungen:	
<p>16.1: schrP90 - written exam, 90 minutes 16.2: LN - participation without/with success</p> <p>Additional Explanation: A prerequisite for participation in the written examination is a successfully completed practical course (see SPO-No. 16.2). In order to meet the admission requirements for participation in the final and graded written exam, a semester-long internship must be passed "with success". For this purpose, a total of one assignment must be successfully completed.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>On successful completion of the course, students are:</p> <ul style="list-style-type: none"> • able to explain the characteristics of Big Data and basic data management technologies and techniques. • are familiar with the basic concepts of relational database systems and are able to create efficient database designs for various use cases. • work with data stored in a relational DBMS by applying SQL to create database tables, extract, present, and modify data. • are able to explain the motivation and development of post-relational data management systems. • are able to describe the essential characteristics of the central categories of NoSQL systems, their advantages and limitations. <p>The lecture is supplemented by the practical course in order to deepen the theoretical concepts in practice. In the practical course, the contents of the lecture are deepened by means of practical tasks.</p>	
Content:	
<ul style="list-style-type: none"> • Introduction: Definition of Big Data, Big Data Use Cases, data types, data structures • Relational Database Management Systems: Overview of core concepts (ER-Diagrams, SQL, index, normalisation, transactions, tuning) 	

- NoSQL Systems: Motivation and core concepts (CAP, Replication, Wide Column Stores, Graph database, Document Stores, Key-Value Stores)
- Optimized storage formats for Big Data (Parquet, Avro, ORC)
- Distributed filesystems and distributed computing frameworks (Hadoop, MapReduce, Spark)
- Data Lake architectures and modern data management concepts

Literature:

- PERKINS, Luc, 2018. *Seven Databases in Seven Week: A Guide to Modern Databases and the Nosql Movement*.
- KLEPPMANN, Martin, 2017. *Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems*. ISBN 978-1-449-37332-0
- LEMAHIEU , Wilfried, Seppe VANDEN BROUCKE and Bart BAESENS , 2018. *Principles of Database Management: The Practical Guide to Storing, Managing and Analyzing Big and Small Data*. ISBN 978-1107186125

eTHICS_basic	
Module abbreviation:	IB_ETHICS_en
Curriculum:	Programmes
	Cybersicherheit (CSI-B) - SPO-Nr.: 29
Responsible for module:	Crompton, Laura
Lecturers:	Crompton, Laura
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	29: eTHICS_basic
Lecture types:	29: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>29: LN - seminar paper (10-15 pages) and oral presentation (15-30 minutes)</p> <p>Additional Explanation:</p> <p>Grading is three quarters based on five papers (~ 2 pages each) that will be handed in over the course of the term. Paper submissions will be complemented by obligatory in-class presentations (~ 20 minutes).</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>On successful completion of the course, students will be able to</p> <ul style="list-style-type: none"> • outline the most pressing questions currently discussed in the ethics of technology. • distinguish meta-ethical, normative, and empirical arguments in ethics. • apply normative theories from ethics to the field of technology. • apply ethical arguments to case studies from the field of artificial intelligence, e.g., self-driving cars. • discuss the role of empirical research for the ethics of human-machine interaction and machine ethics. • transcend their own normative viewpoint by critically reflecting on it. • formulate their own research questions to inquire into the ethics of technology and outline research designs to address them. 	
Content:	
<p>The ethics of technology deals with moral questions that concern the usage of technologies. It raises fundamental questions about our relationship with technologies.</p> <ul style="list-style-type: none"> • Should we delegate ethical tasks to machines? • Which normative principles should guide the design of our artefacts? • How does the interaction with artefacts influence our moral behavior? • Can we change this influence by the ethically aligned design of the human-machine interface? <p>Certain technologies may raise more specific questions.</p> <ul style="list-style-type: none"> • What are the challenges of hybrid traffic in which manual and automated cars will have to cooperate? • How should medical recommender system communicate uncertainty to medical professionals? • What effects does social media have on our society's culture? <p>In this module, we will discuss recent topics from the realm of the ethics of technology. In biweekly lectures, changing experts will share their views on the ethical implications of different technologies.</p>	

These lectures will be complemented by a pre-reading course in which students will individually familiarize themselves with relevant literature from the field and together subject this literature to criticism.

Students will be required to summarize their learnings from the lectures and the literature in reflection reports. To complete the module, they will also have to actively participate in the “eTHics conference,” in which they will give a presentation on a relevant topic and participate in a peer-evaluation of the topics presented.

Literature:

- SHAFER-LANDAU, Russ, 2019. *A Concise Introduction to Ethics*. ISBN 978-0190058173
- LIAO, S. Matthew, 2020. *Ethics of artificial intelligence*. New York, NY: Oxford University Press. ISBN 978-0-19-090503-3, 978-0-19-090504-0

Human-Computer Interaction and Explainable AI - (practical course)	
Module abbreviation:	CAI_HCI
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 22
Responsible for module:	Huber, Tobias
Lecturers:	Huber, Tobias
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	27: Human-Computer Interaction and Explainable AI
Lecture types:	27: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>27: schrP90 - written exam, 90 minutes</p> <p>Additional Explanation:</p> <p>In order to meet the admission requirements for participation in the final and graded written exam, a semester-long project must be passed „with success“. For this purpose, a total of one assignment must be successfully completed and presented in time.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>After attending the module and actively participating in the course</p> <ul style="list-style-type: none"> • ...students know the Usability Life Cycle and can name and apply its individual phases. • ...students are able to list and correctly use common creativity technologies. • ...know common prototyping methods and have acquired the competence to select and apply the best possible method for a concrete scenario. • ...have acquired the ability to distinguish and correctly apply models and theories for measuring interaction performance. • ...students have acquired comprehensive basics of qualitative and quantitative assessment of human-machine interaction. • ...students understand basic human information processing and know why you need to consider and use this knowledge in interaction design. • ...students are familiar with relevant methods for simple user studies and are able to apply them. • ...students are able to design and conduct user studies and interpret the results. • ...students know standardized questionnaires and have the competence to design simple questionnaires themselves and to conduct questionnaire surveys and interviews. • ...students are able to identify and illustrate existing approaches in Explainable AI. • ...students have acquired the ability to discuss and compare different methods for increasing system interpretability and transparency. • ...students are able to identify and describe different ways of evaluating system explainability, accountability and intelligibility. • ...students are able to identify and describe how to design interfaces to increase AI system predictability. <p>Self- and social competences: After completion of the module</p>	

- ...students have sufficient ability to plan, conduct, document, interpret and discuss user studies in a group.
- ...know the individual phases in the planning and execution of usability/UX studies and are thus able to independently conduct research (e.g., thesis)

Content:

This course covers, embedded in the User-Centered Design process, methodological knowledge for the targeted evaluation of human-machine interfaces, the generation of ideas and prototypes in different product development phases, as well as basic knowledge about technologies for human-machine interaction. The module is supplemented by an in-depth treatment of explainable artificial intelligence (XAI).

Lectures

- Definitions of terms and key constructs
- The human-centered design process
- Scientific evaluation of human-machine interfaces (study design, hypothesis testing, etc.)
- Human factors" fundamentals: "Human-in-the-loop" systems (input/output, decision making, etc.)
- Design principles (colors, shapes, Gestalt law, etc.)
- Prediction models (Fitts's law, Hicks's law, GOMS, KLM, etc.)
- Input and output devices for 2D/3D
- Definition of Explainable AI (XAI)
 - Explanations in different fields of AI
 - The role of humans
 - Evaluation protocols and metrics
- Explainable Machine Learning
 - What is a Black Box?
 - Interpretable, Explainable and Comprehensible Models
 - Open the Black Box Problem

Practical course

- Structured application of the human-centered design process
- Design and implementation of user studies
- Requirements elicitation
- Idea generation and prototyping (sketching, wireframes, video-, soft- and hardware prototyping)
- Realization and evaluation of XAI applications
- Application of evaluation methods (interviews, questionnaires, lab and field experiments)

Literature:

- LAZAR, Jonathan, FENG, Jinjuan Heidi, HOCHHEISER, Harry, 2017. *Research methods in human-computer interaction* [online]. Cambridge, MA: Morgan Kaufmann Publishers, an imprint of Elsevier PDF e-Book. ISBN 978-0-12-809343-6. Available via: <https://doi.org/10.1016/B978-0-12-805390-4.09991-X>.
- DIGNUM, Virginia, 2019. *Responsible Artificial Intelligence: how to develop and use AI in a responsible way* [online]. Cham: Springer PDF e-Book. ISBN 978-3-030-30371-6. Available via: <https://doi.org/10.1007/978-3-030-30371-6>.
- LEE, John D. and others, 2017. *Designing for people: an introduction to human factors engineering*. Charleston, SC: CreateSpace. ISBN 978-1-5398-0800-8, 1-5398-0800-9
- MILLER, Tim, 2019. Explanation in artificial intelligence: Insights from the social sciences. In: *Artificial intelligence*. (267), p.1-38. ISSN <https://doi.org/10.1016/j.artint.2018.07.007>
- JOSHI, Ameet V., 2023. *Machine learning and artificial intelligence* [online]. Cham: Springer PDF e-Book. ISBN 978-3-031-12282-8. Available via: <https://doi.org/10.1007/978-3-031-12282-8>.
- FIELD, Andy and Graham HOLE, 2003. *How to design and report experiments*. London ; Thousand Oaks ; New Delhi: Sage Publications. ISBN 978-0-7619-7383-6, 0-7619-7383-4
- MOLNAR, Christoph, 2022. *Interpretable machine learning: a guide for making black box models explainable*. Munich: Christoph Molnar. ISBN 9798411463330 <https://christophm.github.io/interpretable-ml-book/>. - kostenfrei

Information and Product Security Management and Communication - Master	
Module abbreviation:	SOC_IPSMC
Curriculum:	Programmes
	Socialtechnical Cybersecurity (SOC-M) - SPO-Nr.: 4
Responsible for module:	Gmelch, Oliver
Lecturers:	Gmelch, Oliver
Language of instruction:	English
Credit points / SWS:	6 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 103 h
	Total: 150 h
Subjects of the module:	4: Information and Product Security Management and Communication
Lecture types:	SU/Ü - Seminar-based teaching with exercises
Studien- / Prüfungsleistungen:	
4: schrP90 - written exam, 90 minutes	
Additional Explanation:	
None	
Recommended prerequisites:	
None	
Objectives:	
<p>After successful completion of this module, students are able to ...</p> <ul style="list-style-type: none"> critically analyse and compare cybersecurity management frameworks and justify their application in different organisational and product contexts. design and evaluate cybersecurity governance structures within corporate environments, including roles, responsibilities and decision-making processes. develop and apply structured threat and risk models for complex socio-technical systems and derive evidence-based risk treatment strategies. analyse security- and risk-related data sets and translate results into meaningful management reports for technical and non-technical stakeholders. assess cybersecurity maturity using established maturity models and formulate targeted improvement roadmaps. design business continuity concepts and evaluate organisational resilience with regard to cyber-related disruption scenarios. plan and implement cybersecurity awareness strategies that are appropriate for different target groups and organisational cultures. manage cybersecurity incidents and crisis situations, including structured communication with internal and external stakeholders. design and evaluate product security management processes across the lifecycle of digital and cyber-physical products. 	
Content:	
<ul style="list-style-type: none"> Cybersecurity Management Frameworks (e.g., ISO 27001, NIST CSF) Cybersecurity in corporate governance Threat and Risk Modeling and Management Data Analysis for Risk and Security Management/Reporting 	

- Cybersecurity Maturity models
- Business Continuity Management
- Cybersecurity Awareness
- Crisis Communication & Incident Management
- Product Security Management

Literature:

- EDWARDS, Jason and Griffin WEAVER, 2024. *The cybersecurity guide to governance, risk, and compliance*. Hoboken, NJ: Wiley. ISBN 9781394250196, 1394250193
- TOKGOZ, Emre, 2026. *Six Sigma for Continuous Improvement in Cybersecurity: A Guide for Students and Professionals* [online]. Cham: Springer Nature Switzerland PDF e-Book. ISBN 978-3-031-91030-2. Available via: <https://doi.org/10.1007/978-3-031-91030-2>.

Introduction to Computer Science 2	
Module abbreviation:	CAI_CS2
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 7
Responsible for module:	Sofra, Nikoletta
Lecturers:	Sofra, Nikoletta
Language of instruction:	English
Credit points / SWS:	7 ECTS / 4 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	7.1: Introduction to Computer Science 2
Lecture types:	7.1: SU - integrated lecture 7.2: Ü - exercises
Studien- / Prüfungsleistungen:	
7.1: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
Successful participation in module "Introduction to Computer Science 1"	
Objectives:	
<p>This course aims to create a basic understanding of computer system design principles. The course comprises two parts: operating systems and communication networks.</p> <p>The first part focuses on conveying how the operating system manages the different components of a computer, so that they can be shared by one or more application programs that run simultaneously. The second part focuses on conveying how computers can communicate and interact with each other over fixed or mobile networks.</p> <p>After successful participation, the students are able</p> <ul style="list-style-type: none"> • to explain the tasks and functions of operating systems. • to understand and use basic operating system concepts, assess corresponding implementations and challenges. • classify existing operating systems and assess future developments. <p>They are also able</p> <ul style="list-style-type: none"> • to describe and classify the basic concepts of computer networks. • to explain the tasks of communication layers in a reference model and to identify them. • to understand the most important principles of communication protocols and to describe their characteristics and limits. 	
Content:	
<p>The content of this course covers the following subject areas:</p> <ul style="list-style-type: none"> • Operating systems <ul style="list-style-type: none"> ○ Definition and overview ○ Processes and threads ○ Memory management 	

- File systems
- I/O management
- Computer networking
 - Definition and overview
 - Architecture
 - Application Layer
 - Transport Layer
 - Network Layer and routing
 - Link Layer
 - Wireless and mobile networks

Literature:

- TANENBAUM, Andrew S. and Herbert BOS, 2023. *Modern operating systems*. Boston [u.a.]: Pearson.
- KUROSE, James F. and Keith W. ROSS, 2022. *Computer networking: a top-down approach*. Harlow: Pearson. ISBN 978-1-292-40546-9, 1-292-40546-5
- TANENBAUM, Andrew S., David WETHERALL and Nick FEAMSTER, 2020. *Computer networks*. Harlow, United Kingdom: Pearson Education Limited. ISBN 978-1-292-37401-7
- SILBERSCHATZ, Abraham, Peter B. GALVIN and Greg GAGNE, 2019. *Operating system concepts*. Hoboken, NJ: Wiley. ISBN 978-1-119-45408-3
- STALLINGS, William, 2018. *Operating systems: internals and design principles*. Harlow, Essex, England: Pearson. ISBN 1-292-21430-9, 978-1-292-21430-6

Mathematics 2	
Module abbreviation:	CAI_Math2
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 8
Responsible for module:	Roegner, Katherine
Lecturers:	Roegner, Katherine
Language of instruction:	English
Credit points / SWS:	7 ECTS / 4 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	8.1: Mathematics 2
Lecture types:	8.1: SU/Ü - integrated lecture and exercises 8.2: Ü - exercises
Studien- / Prüfungsleistungen:	
8.1: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Upon completion of this course, the student is able to:</p> <ul style="list-style-type: none"> manipulate matrices for specific purposes. identify vector spaces and linear mappings between vector spaces. apply theorems of linear algebra correctly. identify bases with special properties (orthonormal basis, diagonalizing basis, etc.). change between bases. 	
Content:	
<p>Upon completion of this course, the student is able to:</p> <ul style="list-style-type: none"> perform standard matrix operations (addition, scalar multiplication, matrix multiplication, transposition, determinant) solve systems of linear equations efficiently, thereby identifying a particular solution and the kernel of the coefficient matrix decide whether a given structure represents a subspace of a vector space decide whether a mapping is linear, injective, surjective, bijective apply the dimension theorem in concrete situations determine coordinate mappings and representing matrices especially under a change of basis orthogonalize a given basis and deduce a QR-factorization of the associated matrix apply properties of the determinant in concrete situations understand the eigenvalue/eigenvector equation algebraically und graphically compute eigenvalues and eigenvectors decide on the diagonalizability of a given matrix 	

Literature:

- ARANGALA, . *Linear Algebra with Machine Learning and Data*.
- AXLER, Sheldon Jay, 2024. *Linear algebra done right* [online]. Cham, Switzerland: Springer PDF e-Book. ISBN 978-3-031-41026-0. Available via: 20.500.12854/121457.

Multimodal, Interactive Systems - Master	
Module abbreviation:	UXDM_MIS
Curriculum:	<p style="text-align: center;">Programmes</p> Künstliche Intelligenz (Master) (KI-M) - SPO-Nr.: 8 User Experience Design (Master) (UXD-M) - SPO-Nr.: 3
Responsible for module:	Nestler, Simon
Lecturers:	Nestler, Simon
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h
Subjects of the module:	8: Multimodal, Interactive Systems
Lecture types:	8: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
8: schrP90 - written exam, 90 minutes Additional Explanation: The teaching concept of this course closely connects theoretical foundations and practical applications. Thus, this course is designed workshop-like: The learning contents are presented in relation to concrete areas of application and are deepened by concrete group and single tasks. The active participation of the students is explicitly desired.	
Recommended prerequisites:	
None	
Objectives:	
After successfully completing the module, students are able to ... <ul style="list-style-type: none"> analyze human perception and action modalities and judge their suitability for specific interactive application contexts. design and prototype multimodal user interfaces by combining appropriate modalities in a purposeful and technically sound manner. evaluate the usability and practicality of multimodal interactive systems using suitable scientific methods and criteria. analyze the accessibility of multimodal systems with regard to different user needs and derive evidence-based improvement measures. implement accessibility improvements by integrating and adapting multimodal interaction techniques. Self- and social competences After successfully completing the module, students are able to ... <ul style="list-style-type: none"> apply principles of scientific work to the design, documentation and evaluation of multimodal interfaces. communicate design rationales, results and evaluations clearly and appropriately using suitable media formats. collaborate effectively in intercultural and interdisciplinary teams and assume roles responsibly to successfully contribute to joint project outcomes. 	
Content:	
<ul style="list-style-type: none"> Case study: Development and evaluation of multimodal user interfaces Graphic modalities and visual communication for interaction 	

- Acoustic and haptic modalities and their integration in multimodal systems
- Natural User Interfaces: Foundations, ergonomics, multisensory evaluation
- Touch gesture interaction: Concepts, models, design principles
- In-air gesture interaction: 3D interaction concepts, sensing technologies, design considerations
- User experience of Natural User Interfaces: Process models, social context, error handling, feedback
- From screen-based interaction to experience-centered interaction
- Post-visual interaction concepts and usage patterns
- Foundations and terminology of Voice User Interfaces
- Conversational interaction and chatbot design
- Advanced VUI concepts including adaptivity, help strategies, interruption handling and evaluation

Literature:

- PEARL, Cathy, December 2016. *Designing voice user interfaces: principles of conversational experiences*. Beijing ; Boston ; Farnham ; Sebastopol ; Tokyo: O'Reilly. ISBN 978-1-4919-5538-3
- COHEN, Michael H., James P. GIANGOLA and Jennifer BALOGH, 2004. *Voice user interface design*. Boston [u.a.]: Addison-Wesley. ISBN 0-321-18576-5
- KRISHNA, Golden, 2015. *The best interface is no interface: the simple path to brilliant technology*. San Francisco, Calif.: Pearson Education, New Riders. ISBN 978-0-133-89033-4, 0-133-89033-3
- LEE, Henry, 2018. *Voice user interface projects: build voice-enabled applications using Dialogflow for Google Home and Alexa Skills Kit for Amazon Echo*. Birmingham, UK: Packt Publishing. ISBN 978-1-78847-335-4
- WILLIAMS, Sam, 2016. *Hands-on chatbot development with Alexa Skills and Amazon Lex: create custom conversational and voice interfaces for your Amazon Echo devices and web platforms*. Birmingham ; Mumbai: Packt. ISBN 978-1-78899-348-7

Programming 2 (with practical course)	
Module abbreviation:	CAI_Prog2
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 6
Responsible for module:	Windisch, Hans-Michael
Lecturers:	Windisch, Hans-Michael (CAI_Prog2) Windisch, Hans-Michael (CAI_Prog2Pr)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	6.1: Programming 2 6.2: Practical Course Programming 2
Lecture types:	6.1: SU/Ü - integrated lecture and exercises 6.2: Pr - laboratory
Studien- / Prüfungsleistungen:	
<p>6.1: schrP90 - written exam, 90 minutes 6.2: LN - participation without/with success</p> <p>Additional Explanation: A prerequisite for participation in the written examination is a successfully completed practical course (see SPO-No. 6.2). Within the practical course, five tasks, which deal with essential topics of the lecture will be given. To pass the practical course, all five tasks must be completed successfully with respect to task deadlines.</p>	
Recommended prerequisites:	
Python programming to the extent of Programming 1	
Objectives:	
<p>Lecture: After successful participation students are able to:</p> <ul style="list-style-type: none"> • explain the basics of object-oriented programming. • use basic abstract data structures for algorithmic problem solving. • create an algorithmic solution for moderately difficult problems. • formulate given and self-designed data structures and algorithms in Java. <p>Practical Course: Upon completion of the course students have practical knowledge in the application of essential Java programming concepts such as inheritance, interface, etc. They also gain initial experience with the JUNIT test framework and user interface programming with JavaFX.</p>	
Content:	
<p>Lecture:</p> <ul style="list-style-type: none"> • Basics of object-oriented programming; key terms: class, object, method, message, interface, inheritance, polymorphism, etc. • Programming knowledge in Java (general OOP and in the Java language: sequence control, data types, class libraries, programme structure via class hierarchy, parameter transfer mechanisms, lifetime and usability of objects, work of the garbage collector) • Object-oriented modelling (data encapsulation and access protection in classes, structuring inheritance hierarchies, use of class libraries: collections, streams, threads) 	

- Dynamic data structures: linked lists, hash tables, trees, streams
- Advanced language concepts: interface definition via interfaces, exception handling, parameterised classes (generics), lambda expressions
- Graphical user interfaces with JavaFX, handling asynchronous events
- Parallel programming with threads

Practical course:

As part of the practical course, a media player is developed in the Java programming language. The player is operated via a JavaFX-based user interface. The acceptance tests are carried out automatically using predefined JUNIT test classes. The classes to be created must provide certain interface functionalities in order to successfully pass the tests.

Literature:

- SHARAN, Kishori, DAVIS, Adam L., 2022. *Beginning Java 17 Fundamentals: Object-Oriented Programming in Java 17* [online]. Berkeley, CA: Apress PDF e-Book. ISBN 978-1-4842-7307-4. Available via: <https://doi.org/10.1007/978-1-4842-7307-4>.
- STREIB, James T. , SOMA, Takako, 2023. *Guide to Java - A Concise Introduction to Programming* [online]. PDF e-Book. ISBN 978-3-031-22842-1. Available via: <https://doi.org/10.1007/978-3-031-22842-1>.

Programming for Multimodal, Interactive Systems - Master	
Module abbreviation:	UXDM_PMIS
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 6
Responsible for module:	Nestler, Simon
Lecturers:	Nestler, Simon (UXDM_PMIS) Nestler, Simon (UXDM_PMISUE)
Language of instruction:	English
Credit points / SWS:	6 ECTS / 5 SWS
Workload:	Contact hours: 59 h
	Self-study: 91 h
	Total: 150 h
Subjects of the module:	3.1: Programming for Multimodal, Interactive Systems 3.2: Exercises in Programming for Multimodal, Interactive Systems
Lecture types:	: SU/Ü - seminaristischer Unterricht/Übung; : Ü - Übung
Studien- / Prüfungsleistungen:	
3.1: schrP90 - written exam, 90 minutes 3.2: LN - without assessment Additional Explanation: The teaching concept of this course closely connects theoretical foundations and practical applications. Thus, this course is designed workshop-like: The learning contents are presented in relation to concrete areas of application and are deepened by concrete group and single tasks. The active participation of the students is explicitly desired.	
Recommended prerequisites:	
There are no prerequisites or corequisites for this class. However, a basic understanding of various technologies related to human-machine interaction would be beneficial.	
Objectives:	
After successfully completing the module, students are able to ...	
<ul style="list-style-type: none"> • analyze human perception and action modalities and judge their suitability for specific interactive application contexts. • design and prototype multimodal user interfaces by combining appropriate modalities in a purposeful and technically sound manner. • evaluate the usability and practicality of multimodal interactive systems using suitable scientific methods and criteria. • analyze the accessibility of multimodal systems with regard to different user needs and derive evidence-based improvement measures. • implement accessibility improvements by integrating and adapting multimodal interaction techniques. 	
Self- and social competences	
After successfully completing the module, students are able to ...	
<ul style="list-style-type: none"> • apply principles of scientific work to the design, documentation and evaluation of multimodal interfaces. • communicate design rationales, results and evaluations clearly and appropriately using suitable media formats. • collaborate effectively in intercultural and interdisciplinary teams and assume roles responsibly to successfully contribute to joint project outcomes. 	

Content:

- Case study: Development and evaluation of multimodal user interfaces
- Graphic modalities and visual communication for interaction
- Acoustic and haptic modalities and their integration in multimodal systems
- Natural User Interfaces: Foundations, ergonomics, multisensory evaluation
- Touch gesture interaction: Concepts, models, design principles
- In-air gesture interaction: 3D interaction concepts, sensing technologies, design considerations
- User experience of Natural User Interfaces: Process models, social context, error handling, feedback
- From screen-based interaction to experience-centered interaction
- Post-visual interaction concepts and usage patterns
- Foundations and terminology of Voice User Interfaces
- Conversational interaction and chatbot design
- Advanced VUI concepts including adaptivity, help strategies, interruption handling and evaluation

Literature:

- KRISHNA, Golden, 2015. *The best interface is no interface: the simple path to brilliant technology*. San Francisco, Calif.: Pearson Education, New Riders. ISBN 978-0-133-89033-4, 0-133-89033-3
- PEARL, Cathy, December 2016. *Designing voice user interfaces: principles of conversational experiences*. Beijing ; Boston ; Farnham ; Sebastopol ; Tokyo: O'Reilly. ISBN 978-1-4919-5538-3
- COHEN, Michael H., James P. GIANGOLA and Jennifer BALOGH, 2004. *Voice user interface design*. Boston [u.a.]: Addison-Wesley. ISBN 0-321-18576-5
- LEE, Henry, 2018. *Voice User Interface Projects: Build voice-enabled applications using Dialogflow for Google Home and Alexa Skills Kit for Amazon Echo*. Birmingham: Packt Publishing Limited. ISBN 978-1-78847-022-3
- WILLIAMS, Sam, 2018. *Hands-On Chatbot Development with Alexa Skills and Amazon Lex: Create custom conversational and voice interfaces for your Amazon Echo devices and web platforms*. Birmingham: Packt Publishing Limited. ISBN 978-1-78899-243-5

Project Management	
Module abbreviation:	CAI_PrMgmt
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 24
Responsible for module:	Märtens, Holger
Lecturers:	Märtens, Holger
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	24: Project Management
Lecture types:	SU/Ü - lecture with integrated exercises (CAI_PrMgmt)
Studien- / Prüfungsleistungen:	
24: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After attending the module, the students will</p> <ul style="list-style-type: none"> • have obtained basic skills for the management of small and medium-sized IT projects. • be familiar with the relevant steps in the preparative planning phase of a project, • be able to organize an adequate project kick-off and to carry out all necessary preparatory work and analyses. • be able to plan a project in detail. • know several methods to analyze an ongoing project and to make trend statements about its progress. • understand relevant dependencies in the course of projects and be able to control of a project based on well-founded methods. • be familiar with key approaches and methods of agile project management. • have practiced central aspects of project management on a sample case by means of group exercises. • have had the opportunity to demonstrate and discuss their results in a short presentation. 	
Content:	
<p>1 Basics</p> <ul style="list-style-type: none"> ○ Definition of project ○ Project triangle (time, budget, scope) ○ Project organization <p>6. Preparing a project</p> <ul style="list-style-type: none"> ○ Process models ○ Goal definition ○ Stakeholder analysis/management ○ Risk analysis/management ○ Scope and kick-off 	

7. Planning a project

- Work breakdown structure
- Schedule/network maps
- Effort estimation
- Resource planning

8. Implementing a project

- Progress and trend analysis
- Cost management
- Reporting and communication
- Project control and change management

9. Agile project management

- Basic concepts
- The Agile Manifesto
- IT Kanban
- Scrum
- Hybrid project management

Group exercises will be performed for key contents to consolidate what has been learned.

Literature:

Will be specified at the beginning

Research Methods in HCI - Master	
Module abbreviation:	UXDM_RM
Curriculum:	Programmes
	User Experience Design (Master) (UXD-M) - SPO-Nr.: 1
Responsible for module:	Riener, Andreas
Lecturers:	Riener, Andreas; Sturm, Christian
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1: Research Methods in HCI
Lecture types:	1: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
1: mdIP - oral exam, 15 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After active participation in the course, students</p> <ul style="list-style-type: none"> • ...have acquired applied understanding of statistical methods and their fields of application • ...have a comprehensive understanding of the criteria that influence the usability/UX of products • ...can use and compare different tools for software and hardware prototyping • ...have gained a deep understanding of criteria that influence the usability/UX of products • ...have acquired knowledge about the operation of essential technologies in human-computer interaction and can use the technologies in a targeted manner • ...have acquired comprehensive knowledge of target group-specific characteristics that play a role in user-centered design and are able to apply this knowledge • ...know how to apply different qualitative and quantitative methods of research • ...have acquired the ability to structure data and create data models • ...are able to capture and validate user requirements • ...are capable of applying evaluation methods for quantitative and qualitative data • ...have acquired extensive skills to interpret results and draw conclusions • ...are able to prepare data visually and in a way that is appropriate for the target group • ...are able to evaluate and improve the usability of products and to differentiate usability from user experience • ...are able to plan, implement, and execute user studies <p>Self- and social competences: Upon completion of the module, students</p> <ul style="list-style-type: none"> • ...are able to grasp the current state of research, to identify gaps and to develop and discuss possible solutions • ...can communicate professionally at an adequate level of abstraction using appropriate forms of media 	

- ...have sufficient abstraction skills and analytical thinking to be able to independently familiarize themselves with new, unfamiliar areas of expertise and complex problems and implement solutions
- ...can professionally acquire study participants and conduct user studies in the lab or field
- ... have gained knowledge independently publish scientific papers with consideration of relevant related work
- ...are able to present research results (in a visually appealing way)

Content:

Quantitative part

- Introduction to human factors engineering, Motivation for human-computer interaction
- Foundations of research
- Designing HCI experiments, Conducting usability studies
- Models and theories of interaction
- Statistical testing, Data evaluation and analysis in SPSS
- Data and information visualization

Qualitative part

- Introduction to qualitative methods
- Qualitative/UX interviewing
- Quality in use, Usability and UX goals
- Methods and tools for rich qualitative data analysis
- Thematic analysis, Data analysis with NVivo
- Observational methods, Naturalistic and contextual research
- Qualitative UX data synthesis and presentation

Literature:

- FIELD, Andy and Graham HOLE, 2008. *How to design and report experiments*. Los Angeles [u.a.]: Sage. ISBN 978-0-7619-7383-6, 0-7619-7382-6
- LAZAR, Jonathan, Jinjuan Heidi FENG and Harry HOCHHEISER, 2017. *Research methods in human-computer interaction*. Cambridge, MA: Morgan Kaufmann Publishers, an imprint of Elsevier. ISBN 978-0-12-809343-6, 0-12-809343-9
- , . Various journal articles (provided in Moodle). In: .
- SHNEIDERMAN, Ben and others, 2016. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. ISBN 978-0134380384
- STANTON, Neville A., 2013. *Human factors methods: a practical guide for engineering and design*. Burlington, VT: Ashgate Publishing Company. ISBN 978-1-4094-5755-8, 1-4094-5755-9
- MACKENZIE, I. Scott, 2013. *Human-computer interaction: an empirical research perspective*. Waltham, Mass.: Morgan Kaufmann. ISBN 978-0-12-405865-1, 978-0-12-407165-0
- LEE, John D. and others, 2017. *Designing for people: an introduction to human factors engineering*. Charleston, SC: CreateSpace. ISBN 978-1-5398-0800-8, 1-5398-0800-9

Scientific Research Methods	
Module abbreviation:	CAI_ScRM
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 10
Responsible for module:	Seidel, Christian
Lecturers:	Seidel, Christian
Language of instruction:	English
Credit points / SWS:	2 ECTS / 2 SWS
Workload:	Contact hours: 23 h
	Self-study: 27 h
	Total: 50 h
Subjects of the module:	10: Scientific Research Methods
Lecture types:	SU/Ü - integrated lecture and exercises
Studien- / Prüfungsleistungen:	
10: LN - participation without/with success Additional Explanation: To pass the module a written research proposal of 1-3 pages is necessary.	
Recommended prerequisites:	
none	
Objectives:	
<p>After attending the lecture, students will be able:</p> <ul style="list-style-type: none"> • to classify the content and form of scientific papers, as well as to write first scientific papers themselves. • to apply scientific tools. • to work with sources and cite correctly. • to classify and choose research methods. • apply project management to research projects. • to design presentations. • to understand the ethical context and evaluate ethical questions. 	
Content:	
<ul style="list-style-type: none"> • Science and research • Scientific works • Scientific working skills • Project Management • Presentation skills • Bachelor thesis, master thesis, dissertation • Ethics in science • Legal considerations 	
Literature:	
<ul style="list-style-type: none"> • PRUZAN, Peter, 2016. <i>Research methodology: the aims, practices and ethics of science</i>. [Cham]: Springer. ISBN 978-3-319-27166-8, 978-3-319-27167-5 • TURNER, Kathy, 2011. <i>Essential academic skills</i>. Oxford: Oxford Univ. Press. ISBN 978-0-19-557605-4, 0-19-557605-5 	

Selected Topics of Operations Research	
Module abbreviation:	IB_STOP
Curriculum:	Programmes
	Cybersicherheit (CSI-B) - SPO-Nr.: 29
Responsible for module:	Krüger, Max
Lecturers:	Krüger, Max
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	29: Selected Topics of Operations Research
Lecture types:	29: SU - lecture
Studien- / Prüfungsleistungen:	
29: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After successfully completing this module, the students ...</p> <ul style="list-style-type: none"> • Category Knowledge: ... have knowledge of important notations, concepts, and methods of Linear Optimization and the selected topics of Operations Research covered. • Category Comprehension: ... understand the benefit of the methods of Linear Optimization and topics covered. ... can explain important notations and concepts using examples and thereby understand the essential methods in theory and practice. • Category Application: ... independently solve typical problems of linear optimization and selected topics covered. ... familiarize themselves with new topics from Operations Research, if necessary. • Category Analysis: ... critically question Operations Research methods with regard to their applicability to existing problems and check the results for plausibility. • Category Evaluation: ... interpret and assess the results in the application context. <p>After successfully completing this module, students are familiar with the selected standard methods of Operations Research and the underlying theory. They are able to apply these to practical problems and, if necessary, solve them with the help of software tools, as well as independently familiarize themselves with supplementary and advanced topics.</p>	
Content:	
<p>0. Introduction to Operations Research</p> <ul style="list-style-type: none"> • A short history of Operations Research • Overview of Operations Research topics and objectives <p>1. Linear Optimization (= Linear Programming)</p>	

- Introduction and foundations of Linear Optimization
- Simplex Method and its theory
- Duality Theory
- various applications of Linear Optimization
- tools for Linear Optimization.

2. Selected Topics from ...

- Integer and Binary Optimization/Programming
- Dynamic Programming
- Nonlinear Optimization/Programming
- Network Optimization
- Metaheuristics
- Game Theory
- Simulation

... including relevant applications and software tools.

Literature:

- HILLIER, Frederick S. and Gerald J. LIEBERMANN, 2024. *Introduction to Operations Research*. 2024. edition. New York, NY: McGraw-Hill. ISBN 978-1-266-93322-6

Specialised Seminar	
Module abbreviation:	CSI_FWS
Curriculum:	Programmes
	Cybersicherheit (CSI-B) - SPO-Nr.: 22
Responsible for module:	Wamser, Markus
Lecturers:	Heinl, Patrizia; Wamser, Markus
Language of instruction:	English
Credit points / SWS:	3 ECTS / 2 SWS
Workload:	Contact hours: 24 h
	Self-study: 51 h
	Total: 75 h
Subjects of the module:	22: Specialised Seminar
Lecture types:	22: S - Seminar
Studien- / Prüfungsleistungen:	
<p>22: seminar paper and presentation</p> <p>Additional Explanation:</p> <p>The Seminararbeit is a term paper with an oral presentation. The length of the term paper according to APO THI: 3000 to 6000 words, approximately 10 to 20 pages. The paper is to be created using a text editor. The oral presentation lasts 30 to 45 minutes.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>At the end of the course, students will be able to</p> <ul style="list-style-type: none"> do a literature review on a given topic. present the topic in an oral presentation using suitable media. write a scientific paper. critically follow a technical presentation and discuss the content with the speaker in a professional manner (strengthening communication skills). 	
Content:	
<ul style="list-style-type: none"> literature review on a topic assigned by the lecturer by lot or election writing a scientific paper on the topic preparation of a presentation on the topic active moderation of the discussion by the lecturer based on prepared questions to the other participants 	
Literature:	
<ul style="list-style-type: none"> KORNMEIER, Martin, 2024. <i>Wissenschaftlich schreiben leicht gemacht: für Bachelor, Master und Dissertation</i> [online]. Bern: Haupt Verlag PDF e-Book. ISBN 978-3-8385-6207-0. Available via: https://elibrary.utb.de/doi/book/10.36198/9783838562070. 	

Secure Systems	
Module abbreviation:	CSI_SIS
Curriculum:	Programmes
	Cybersicherheit (CSI-B) - SPO-Nr.: 11
Responsible for module:	Wamser, Markus
Lecturers:	Wamser, Markus
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	11: Secure Systems
Lecture types:	11: SU/Ü - Seminar-style teaching with exercises
Studien- / Prüfungsleistungen:	
11: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>After participating in the module, students are able to</p> <ul style="list-style-type: none"> describe primary threats to systems and to suggest appropriate protective measures to mitigate or prevent threats. analyze existing systems regarding their IT security and propose suitable measures to increase protection. can describe and evaluate basic and advanced concepts of IT security for operating systems. can describe and evaluate basic and advanced access concepts and authorization concepts and apply them to specific systems. can name relevant standards and can select suitable measures to implement these standards. 	
Content:	
<ul style="list-style-type: none"> Threats to operating systems Basics of security for operating systems Authentication (PAM, LDAP, Kerberos) Authorization concepts (Unix, ACLs, capabilities) Security architectures and security mechanisms for operating systems (memory management, file management, scheduling, I/O, energy management, secure boot, authenticated boot, TPM) Hardening of systems Relevant standards System examples (SEL4, KataOS, SELinux) 	
Literature:	
<ul style="list-style-type: none"> ADKINS, Heather and others, March 2020. <i>Building secure and reliable systems: Best practices for designing, implementing, and maintaining systems</i>. Beijing ; Boston ; Farnham ; Sebastopol ; Tokyo: O'Reilly. ISBN 978-1-492-08312-2 	

- ANDERSON, Ross, 2020. *Security engineering: a guide to building dependable distributed systems* [online]. Indianapolis: Wiley PDF e-Book. ISBN 978-1-119-64468-2, 978-1-119-64283-1. Available via: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119644682>.
- ECKERT, Claudia, 2023. *IT-Sicherheit: Konzepte - Verfahren - Protokolle*. 11. edition. Berlin ; Bosten: De Gruyter Oldenbourg. ISBN 978-3-11-099689-0, 3-11-099689-8

Social Implications of Artificial Intelligence - Master	
Module abbreviation:	AIN_SocImplAI
Curriculum:	Programmes
	Artificial Intelligence (M) (AIN-M) - SPO-Nr.: 6 Cloud Applications und Security Engineering (CSE-M) - SPO-Nr.: 10
Responsible for module:	Crompton, Laura
Lecturers:	Crompton, Laura
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	6: Social Implications of Artificial Intelligence
Lecture types:	6: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
6: mdIP - oral exam, 30 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The module will discuss the impact of the use of artificial intelligence on society. The course is divided into two parts. The first part focuses on the ethical implications of AI. Here, the students will get an introduction to ethics more generally and AI ethics more specifically. Both traditional and non-traditional ethical theories will be addressed. Based on this, the second part of the course will concentrate on applying this to real-world use cases by conducting Ethical Impact Assessments. At the start of the semester, students will choose a use case and work in groups to evaluate it across the four dimensions of the assessment throughout the semester.</p> <p>After completing the module, students will be able to</p> <ul style="list-style-type: none"> • distinguish the categories of ethics and characterise the features of ethical judgments. • describe and criticise the most important normative theories. • elaborate and reflect on specific issues of ethics of technology in general and ethics of AI in particular. • discuss concrete applications of AI against the background of ethical theories. • identify their own research questions on the ethics of AI and outline research designs to address them. • develop and outline Ethical Impact Assessments based on real-world AI use cases. 	
Content:	
<ul style="list-style-type: none"> • Introduction to traditional ethical theories • Introduction to non-traditional ethical theories • Introduction to AI ethics • Instrumentalist theories of technology and post-phenomenology • Narratives around AI • Bias and fairness • Transparency and explainability in AI • AI influence in human-AI interaction 	

- Responsibility and theories of hybrid action
- Environmental aspects around AI
- Risk ethics
- AI governance, responsible AI and the AI Act

Literature:

- AGHION, Philippe and others, 2023. *The power of creative destruction: economic upheaval and the wealth of nations*. Cambridge: The Belknap Press of Harvard University Press. ISBN 9780674292093, 067429209X
- AGRAWAL, Ajay, Joshua GANS and Avi GOLDFARB, 2019. *The economics of artificial intelligence: an agenda*. Chicago and London: <<The>> University of Chicago Press. ISBN 978-0-226-61333-8
- COECKELBERGH, Mark, 2020. *AI ethics* [online]. Cambridge, Massachusetts ; London, England: The MIT Press PDF e-Book. ISBN 978-0-262-35706-7. Available via: <https://doi.org/10.7551/mitpress/12549.001.0001>.
- LIAO, S. Matthew, 2020. *Ethics of artificial intelligence*. New York, NY: Oxford University Press. ISBN 978-0-19-090503-3, 978-0-19-090504-0

Spoken and Natural Language Understanding	
Module abbreviation:	CAI_NatL
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 17
Responsible for module:	Georges, Munir
Lecturers:	Georges, Munir; Tugeev, Sviatoslav (CAI_NatL) Siddig, Ibrahim (CAI_NatLPr)
Language of instruction:	English
Credit points / SWS:	7 ECTS / 6 SWS
Workload:	Contact hours: 70 h Self-study: 105 h Total: 175 h
Subjects of the module:	17.1: Spoken and Natural Language Understanding 17.2: Practical Course Spoken and Natural Language Understanding
Lecture types:	17.1: SU/Ü - lecture with integrated exercises 17.2: Pr - laboratory
Studien- / Prüfungsleistungen:	
<p>17.1: schrP90 - written exam, 90 minutes 17.2: LN - participation without/with success</p> <p>Additional Explanation:</p> <p>A prerequisite for participation in the written examination is a successfully completed practical course (see SPO-No. 17.2).</p> <ul style="list-style-type: none"> • Assignment 1: Statistical approaches in NLP • Assignment 2: Early neural approaches in NLP (pre-transformer era) • Assignment 3: Current advancements in text and speech processing • each assignment is 100 points • For every assignment, there will be 5 to 10 additional points (optional). This will be awarded to the students if they do some small additional experiments. • Maximum points: 300 [300 + 20 (optional additional points) = 320] • Minimum threshold to pass the practical course: 180 points (60%) • The work must be defended in the form of, e.g. a video. • Attendance and active participation are expected. <p>Active and successful participation in the practical course is a prerequisite for taking the written examination in the subject "Spoken and Natural Language Understanding": The practical course comprises 3 projects on different topics, which must be successfully completed and presented in time.</p>	
Recommended prerequisites:	
Mathematics Probability Theory and Statistics Programming	
Objectives:	
After successful participation, students will be able to, <ul style="list-style-type: none"> • explain the basic features of speech and text comprehension. • analyse and evaluate text and speech signals. 	

- classify existing applications and assess future developments.
- use basic speech/text algorithms to solve problems.

Content:

Text processing: natural and formal languages, grammar and statistics, language models

- Audio processing: frequency analysis, feature recognition, acoustic models
- Statistical models and neural networks for speech processing
- Applications:
 - Text analysis, search engines, language understanding (NLP).
 - Translation (NMT)
 - Speech Recognition (ASR)
 - Speech synthesis (TTS)
 - Speech Dialogues/Chatbots

Literature:

- EISENSTEIN, Jacob, 2019. *Introduction to natural language processing*. Cambridge, MA: The MIT Press. ISBN 978-0-262-04284-0, 0262042843
- GOLDBERG, Yoaf, 2016. *A primer on neural network models for natural language processing*. ISBN <https://doi.org/10.1613/jair.4992>
- GOODFELLOW, Ian, Yoshua BENGIO and Aaron COURVILLE, 2016. *Deep learning*. Cambridge, Massachusetts ; London, England: The MIT Press. ISBN 978-0-262-03561-3
- HUANG, Xuedong, Alex ACERO and Hsiao-Wuen HON, 2001. *Spoken language processing: a guide to theory, algorithm, and system development*. Upper Saddle River, NJ: Prentice Hall PTR. ISBN 0-13-022616-5
- JURAFSKY, Dan and James H. MARTIN, 2009. *Speech and language processing: an introduction to natural language processing, computational linguistics, and speech recognition*. Upper Saddle River: Pearson Education International, Prentice Hall. ISBN 0-13-504196-1, 978-0-13-504196-3
- MANNING, Christopher D. and Hinrich SCHÜTZE, 2003. *Foundations of statistical natural language processing*. Cambridge, Mass. [u.a.]: MIT Press. ISBN 0-262-13360-1, 978-0-262-13360-9
- ROCHE, Emmanuel and Yves SCHABES, c1997. *Finite-state language processing*. Cambridge, Mass.: MIT Press. ISBN 0-262-18182-7, 0-262-29095-2

Web Technologies (with practical course)	
Module abbreviation:	CAI_WebT
Curriculum:	Programmes
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 17
Responsible for module:	Djanatliev, Anatoli
Lecturers:	
Language of instruction:	English
Credit points / SWS:	7 ECTS / 0 SWS
Workload:	Contact hours: 70 h
	Self-study: 105 h
	Total: 175 h
Subjects of the module:	
Lecture types:	12.1: SU/Ü - lecture with integrated exercises
	12.2: Pr - laboratory
Studien- / Prüfungsleistungen:	
Additional Explanation: A prerequisite for participation in the written examination is a successfully completed practical course (see SPO No. 12.2).	
Recommended prerequisites:	
Programming concepts like Serialization and Processing of Markup Languages in Python	
Objectives:	
<p>After attending the course, students</p> <ul style="list-style-type: none"> • have theoretical knowledge of modern client- and server-side web technologies. • are able to specify web pages with HTML and to design the layout of the pages by using CSS. • are able to develop dynamic web pages by using the corresponding possibilities of JavaScript. • will be able to develop web applications using PHP and databases. • are able to design and implement standard software architectures for web applications. • know web services and REST to define server interfaces and can develop servers using these interfaces. 	
Content:	
<p>Core technologies of the Web:</p> <ul style="list-style-type: none"> • HTML and CSS (HyperText Markup Language and Cascading Style Sheets) • HTTP (HyperText Transfer Protocol) • Client-side Programming Using JavaScript • Ajax (Asynchronous JavaScript & XML) and JSON (JavaScript Object Notation) • Server-side Programming using PHP and JavaScript • Databases for web applications <p>Subsidiary topics:</p> <ul style="list-style-type: none"> • Web Services (REST), Web Security and Privacy Tools • Responsive Website Design 	

Literature:

Will be specified at the beginning



Course Descriptions

Business School

International Office

Summer term 2026

As per: 2026-02-16

This program and course description becomes effective on 15.03.2026. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations

Betriebswirtschaft Bachelor

Subject	SWS	ECTS
AI - Business Models and Concepts	4	6
Global Automotive Industry	4	6
International Accounting and Auditing	4	6
International Marketing	4	6
Methods & Instruments of Strategic Controlling	4	6
Business in Latin America	2	3
Successful Management in a Global World	2	3
International Sustainability Management	2	3
Risk of greenwashing: How to communicate sustainability	2	3
Marketing	4	5
Strategic Management	6	8
Successful Negotiations in a Global World	2	3

“Strategic Management” is a module that consists of two subjects: “Strategic Management (BW_StratM)” and “Strategic Management / Case Studies (BW_StratM-CS)”: **Please note that both subjects of the module must be attended and passed to receive ECTS!!!**

“Strategic Management” cannot be chosen in combination with “International Strategic Management” (International Management degree program).

Entrepreneurship and Corporate Venturing **Master**

Subject	SWS	ECTS
AI & Smart Data Science	4	5
Strategic Brand Development & Go-to-Market Management	4	5

Global Business Master

Subject	SWS	ECTS
Global Business and Economics 1	4	5
Global Business and Economics 2	4	5
Modern Leadership	4	5

Previous knowledge of business administration is necessary.

Global Economics and Business Management Bachelor

Subject	SWS	ECTS
International Economics	4	6
Sustainability, CSR and Compliance Management	4	6

International Management Bachelor

Subject	SWS	ECTS
HR Management & Organisation	4	5
International Business Diplomacy and Crosscultural Management	4	6
International Business Simulation	3	5
International Strategic Management	4	5

“International Strategic Management” cannot be chosen in combination with “Strategic Management” (Betriebswirtschaft degree program).

Medienpsychologie und Digital Business Bachelor

Subject	SWS	ECTS
Behavioral Economics	4	5

Retail and Consumer Management **Master**

Subject	SWS	ECTS
Retail Lab: Consumer Projects and Project Management	4	5
Supply Chain Management in Retailing	4	5
Pop-up Retail Strategies in an Omnichannel Context	4	5
Retail Business Modelling	4	5
Leading in International Retail Organizations	4	5
Internationalization in Retailing	4	5
Community Management	4	5

1 Module Descriptions

AI - Business Models and Concepts	
Module abbreviation:	BW_DB5
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Baur, Alexander
Lecturers:	Baur, Alexander
Language of instruction:	English
Credit points / SWS:	6 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 103 h
	Total: 150 h
Subjects of the module:	2.3: AI - Business Models and Concepts
Lecture types:	2.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>2.3: LN - written exam, 90 minutes</p> <p>Additional Explanation:</p> <p>Voluntary acquisition of bonus points amounting to 10% of the total number of points in the exam (= max. 9 out of a total of total of 90 points) by creation of a presentation and lecture on one of the AI methods explained in the lecture.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>Artificial Intelligence (AI) applications have now become embedded in most commercial sectors, ranging from supporting functions to stand-alone products. Applications range from support functions (e.g. text recognition) to standalone products (e.g. autonomous driving).</p> <p>The course will focus on two main areas: First, the understanding of the application of AI from an economic perspective, and second, from a technical perspective.</p> <p>In the economic part, students get to know different companies and learn how Artificial Intelligence affects their business model. In the technical part of the course, the aim is to gain an understanding of how the algorithms of artificial intelligence work. Students learn what problems can potentially be addressed using artificial intelligence and where to look for pitfalls.</p>	
Content:	
<ul style="list-style-type: none"> • Business models of AI-driven companies • Basics of Machine Learning • Data Processing • Supervised & Unsupervised Learning • Deep Learning • Reinforcement Learning • Evaluation and Validation 	

Literature:

- DAVENPORT, Thomas H., Erik BRYNJOLFSSON and Andrew MCAFEE, 2019. *Artificial intelligence: insights you need from Harvard Business Review*. Boston, Massachusetts: Harvard Business Review Press. ISBN 978-1-63369-790-4
- MÜLLER, Andreas Christian and Sarah GUIDO, October 2016. *Introduction to machine learning with Python: a guide for data scientists*. Beijing; Boston; Farnham; Sebastopol; Tokyo: O'Reilly. ISBN 978-1-449-36941-5, 1-449-36941-3

AI & Smart Data Science - Master	
Module abbreviation:	ECV_AI&SDS
Curriculum:	Programmes
	Entrepreneurship and Corporate Venturing (ECV-M) - SPO-Nr.: 3
Responsible for module:	Frey, Markus
Lecturers:	Frey, Markus
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	3.2: AI & Smart Data Science
Lecture types:	SC / E: seminar course with exercises
Studien- / Prüfungsleistungen:	
3.2: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
Knowledge	
<ul style="list-style-type: none"> • Machine Learning Paradigms: Demonstrate a comprehensive understanding of supervised, unsupervised, and reinforcement learning, including the mathematical logic and selection criteria for different algorithmic approaches. • Neural Network Foundations: Exhibit a deep understanding of artificial neural network architectures, internal functionalities, and advanced optimization techniques (such as backpropagation and gradient descent). • Large Language Model (LLM) Architectures: Grasp the underlying mechanics of modern LLMs, including transformer architectures, attention mechanisms, and the principles of generative AI. • Technical Ecosystem Mastery: Command a high level of proficiency in Python programming specifically optimized for AI/ML workflows, including the expert application of core libraries such as NumPy, Pandas, PyTorch, and TensorFlow. • Business AI Discussion: Identify and critically evaluate the fundamental challenges, ethical risks, and strategic opportunities inherent in deploying AI and ML algorithms within global business environments. 	
Methodology	
<ul style="list-style-type: none"> • End-to-End Data Science Lifecycle: Develop tailored Python-based solutions for real-world data science projects, encompassing data ingestion, cleaning, exploratory analysis, and model deployment. • Managerial Insight Extraction: Translate technical metrics (e.g., RMSE) into actionable business KPIs and strategic recommendations that drive executive decision-making. • Agentic AI Workflow Design: Architect and implement autonomous, agentic AI workflows using LLMs. This includes creating systems that can plan, use tools, self-correct, and execute multi-step tasks independently. • Architecting Digital Transformation: Analyze, map, and transform legacy business processes into intelligent, automated workflows. This involves leveraging AI-driven automation to accelerate an organization's digital transformation journey and operational scalability. 	
Personality	

- **Proactive Problem-Solver Mentality:** Transition from a passive learner to an active "solution architect," showing the initiative to transform ambiguous business problems into structured AI workflows.
- **Digital Confidence & Self-Efficacy:** Cultivate the professional confidence to independently select, deploy, and defend AI/ML solutions when addressing complex, high-stakes business challenges.
- **Analytical Resilience:** Develop the persistence required to navigate the iterative nature of data science, including debugging, model failure, and the refinement of agentic workflows.
- **Digital Leadership:** Lead the discourse on digital transformation within an organization, guiding teams through the transition from legacy processes to automated, AI-driven environments.

Social Competence

- **Interdisciplinary Translation:** Master the ability to bridge the gap between technical complexity and business strategy by translating AI/ML outputs into clear, compelling **managerial insights** for non-technical stakeholders.
- **Collaborative AI Development:** Demonstrate the ability to work effectively in cross-functional, global teams, integrating diverse economic, ethical, and technical perspectives to achieve a common project goal.
- **Stakeholder Negotiation & Advocacy:** Effectively advocate for data-driven strategies and AI investments, balancing technical feasibility with business constraints and organizational ROI.
- **Knowledge Sharing & Mentorship:** Cultivate a culture of continuous digital growth by effectively documenting workflows and mentoring peers on the application of Python-based AI solutions.

Content:

- **Digitalization in the Business Environment:** Analyzing the organizational shifts required to transition from legacy processes to digital and AI-first business models.
- **Algorithmic Classification:** In-depth study of Supervised, Unsupervised, and Reinforcement Learning paradigms.
- **Algorithm Selection:** Criteria for choosing specific models (e.g., Random Forests, SVM, Clustering) based on business constraints and data availability.
- **Neural Network Foundations:** Understanding the architecture (layers, neurons, weights) and optimization (backpropagation) of artificial neural networks.
- **Large Language Models (LLMs):** Architecture of transformers and the shift toward generative AI.
- **Python for AI/ML:** Fundamental to advanced programming tailored for data science workflows.
- **Library Mastery:** Practical implementation using **NumPy** for numerical logic, **Pandas** for data manipulation, and **PyTorch/TensorFlow** for model building.
- **Agentic AI Workflows:** Designing autonomous systems that do not just predict but *act*—implementing multi-step planning, tool-use, and self-correction cycles.
- **Autonomous Decision-Making:** Engineering "agents" capable of independent problem-solving within defined business guardrails.

Literature:

- AGRAWAL, Ajay and others, 2018. *Prediction machines: the simple economics of artificial intelligence*. Grand Haven, USA: Brilliance Audio. ISBN 978-1-7213-5717-8
- FROCHTE, Jörg, 2019. *Maschinelles Lernen: Grundlagen und Algorithmen in Python: mit 146 Abbildungen, 22 Tabellen und zahlreichen Beispielen*. München: Hanser. ISBN 978-3-446-45996-0, 3-446-45996-0
- MÜLLER, Andreas Christian, Sarah GUIDO and Kristian ROTHER, 2017. *Einführung in Machine Learning mit Python: Praxiswissen Data Science*. Heidelberg: O'Reilly. ISBN 978-3-96009-049-6, 3-96009-049-8

Behavioral Economics	
Module abbreviation:	MPS_VM_BE
Curriculum:	Programmes
	Medienpsychologie und Digital Business (MPS-B) - SPO-Nr.: 2
Responsible for module:	Gallier, Carlo
Lecturers:	Gallier, Carlo
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	2.11: Behavioral Economics
Lecture types:	2.11: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
2.11: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Knowledge competence: Students will gain the knowledge to analyze when and how actual human behavior systematically deviates from standard economic predictions.</p> <p>Methodological competence: Students</p> <ul style="list-style-type: none"> will use this knowledge to develop the methodological competencies to combine economic theories with psychological insights into behavioral economic approaches. will use the methodological competencies to apply behavioral economics to economic situations and explain why human behavior deviates from standard economic predictions. <p>Personal/self-competence: Students will apply the competencies to reflect on their own personal choices and design mechanisms to help themselves and others make better decisions.</p> <p>Social competence: Students will apply the competencies to design and critically discuss mechanisms for effectively addressing major societal challenges.</p>	
Content:	
<p>The course provides an applied introduction to behavioral economics. Students learn to combine economic theories with psychological insights to explain why humans make the choices that they do. We focus on economic decision-making at both the individual and organizational level.</p> <p>Standard economic theory often fails to explain actual human behavior. The "homo economicus" at the center of standard economic theory is a prototype who always acts rationally, is selfish, and has unlimited willpower. Behavioral economics puts these assumptions to the test. It shows that humans are often more prone to</p>	

cognitive biases, process information less effectively, and behave more impulsively and socially than the homo economicus would suggest. Students learn to apply insights from behavioral economics to better understand actual human decision making and thus improve the predictive power of economic theories.

Throughout the course, we will cover the central concepts and methods of behavioral economics. We apply this knowledge to a variety of business decisions. The interdisciplinary approach helps students to question their own choices, to better understand consumer behavior, to optimize cooperative processes, and to effectively address societal challenges – such as mitigating climate change.

With a strong focus on applications, we cover

- the basics of economic decision making
- the principles of behavioral economics
- the methods of behavioral economics
- heuristics and cognitive biases
- decisions under risk and uncertainty
- intertemporal decisions
- social norms, fairness, and reciprocity
- and much more if time permits.

Literature:

- CARTWRIGHT, Edward, 2018. *Behavioral Economics*.
- KAHNEMAN, Daniel, 2013. *Thinking, fast and slow*. New York: Farrar, Straus and Giroux.
- THALER, Richard and Cass SUNSTEIN, 2008. *Nudge: Improving decisions about health, wealth, and happiness*.

Business in Latin America	
Module abbreviation:	FW_BUSLA
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Orozco de Plesnar, Roxana Xonali
Lecturers:	Orozco de Plesnar, Roxana Xonali
Language of instruction:	English
Credit points / SWS:	3 ECTS / 2 SWS
Workload:	Contact hours: 23 h
	Self-study: 52 h
	Total: 75 h
Subjects of the module:	2.1.9: Business in Latin America
Lecture types:	2.1.9: S - seminar
Studien- / Prüfungsleistungen:	
2.1.9: LN - seminar paper Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
The students <ul style="list-style-type: none"> are able to understand the potential and the challenges of conducting business in Latin America. acquire practical knowledge in cultural, managerial, economic, political and legal issues. 	
Content:	
Introduction to the Latin American subcontinent: <ul style="list-style-type: none"> Geographic scope Common historic roots - Conducting business in Latin America Latin American cultures: similarities and differences Pragmatic overview of classic/ contemporary cultural studies on Latin America Economic outlook for the region Foreign direct investment 	
Literature:	
<ul style="list-style-type: none"> BALL, Donald and others, 2012. <i>International Business: The Challenge of Global Competition</i>. 13. edition. New York: McGraw-Hill. ISBN 978-0077606121 BEAMISH, Paul W. and Allen J. MORRISON, 2003. <i>International Management, Text and Cases</i>. New York: McGraw-Hill. ISBN 978-0071151405 HOUSE, Robert J. and others, 2004. <i>Culture, Leadership, and Organizations. The GLOBE-Study of 62 Societies</i>. London: Thousand Oaks. ISBN 978-0761924012 LENARTOWICZ, Tomasz and James JOHNSON, 2002. <i>Comparing Managerial Values in Twelve Latin American Countries: An Exploratory Study</i>. In: <i>Management International Review</i>, Vol. 42. ALBERT, Rosita Daskal, 1996. A Framework and Model for Understanding Latin American and Latino/ Hispanic Cultural Patterns. In: <i>Landis: Handbook of Intercultural Training</i>, p.317-348. 	

Community Management - Master	
Module abbreviation:	RCM_CM_1.3 Ind. Elective
Curriculum:	Programmes
	Retail und Consumer Management (RCM-M) - SPO-Nr.: 1
Responsible for module:	Lesser, Sebastian
Lecturers:	Lesser, Sebastian
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1.3: Community Management
Lecture types:	1.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
1.3: project report. Practical work. Written composition approx. 10-15 pages with presentation 15-30 minutes. Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Subject competence</p> <ul style="list-style-type: none"> • Define Community Management and understand its strategic relevance. • Differentiate types of communities. • Explain community lifecycles and strategies. • Identify motivations of members. • Develop communication and engagement concepts. • Recognize challenges such as trolling and crises. <p>Methodological competence</p> <ul style="list-style-type: none"> • Apply community-building methodologies. • Create community marketing concepts. • Design crisis communication protocols. • Develop practical community concepts. <p>Personal/Self-competence</p> <ul style="list-style-type: none"> • Reflect on community manager roles. • Demonstrate empathy and resilience. • Work independently on community concepts. <p>Social competence</p> <ul style="list-style-type: none"> • Conduct dialogue management. • Moderate discussions respectfully. • Manage difficult interactions. • Collaborate in group settings. 	

Content:

1. Foundations of Community Management
2. Types of Communities
3. Community Building
4. Community Nurturing
5. Dialogue Management
6. Integrated project: complete community concept development

Literature:

- Will be announced at course start.
- Standard literature on community building and communication.

Global Automotive Industry	
Module abbreviation:	BW_AM1
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Becker, Thomas
Lecturers:	Becker, Thomas; Derer, Markus
Language of instruction:	English
Credit points / SWS:	6 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 103 h
	Total: 150 h
Subjects of the module:	2.3: Global Automotive Industry
Lecture types:	2.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
2.3: LN - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
An in-depth study of literature is highly recommended.	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> understand the automotive industry structure, current issues, industry trends as well as industry challenges and will have a broad overview on automotive core competencies understand effective leadership and management skills with respect to special issues surrounding the automotive industry are able to learn to research, organize, evaluate, synthesize and analyze financial and economic information for business decision making purposes know project problem resolution processes by applying structured approaches for logic writing and thinking 	
Content:	
<p>This business management course with applied focus on the automotive industry covers the following contents:</p> <ul style="list-style-type: none"> Automotive markets and structure of domestic and global automotive industry Technical basics of automotive products and industry/ technology trends Process model and core processes in the automotive supply chain Product manufacturing, procurement and logistics in the automotive industry Product development and advanced engineering in the automotive industry Marketing and sales in the automotive industry Characteristics of financial management in the automotive industry Future mobility concepts and trends 	
Literature:	
<ul style="list-style-type: none"> GOBETTO, Marco, 2014. <i>Operations Management in Automotive Industries: From Industrial Strategies to Production Resources Management, Through the Industrialization Process and Supply Chain to Pursue</i> 	

Value Creation [online]. PDF e-Book. ISBN 978-94-007-7593-0. Available via: <https://doi.org/10.1007/978-94-007-7593-0>.

- MORGAN, James M. and Jeffrey K. LIKER, 2006. *The Toyota product development system: integrating people, process, and technology*. New York, NY: Productivity Press. ISBN 1-56327-282-2, 978-1-563-27282-0
- SHINGŌ, Shigeo, 2008. *A study of the Toyota production system from an industrial engineering viewpoint*. Boca Raton, Fla. [u.a.]: CRC Press. ISBN 0-915299-17-8
- WOMACK, James P., Daniel T. JONES and Daniel ROOS, 2007. *The machine that changed the world: the story of lean production; Toyota's secret weapon in the global car wars that is revolutionizing world industry*. New York, NY [u.a.]: Free Press. ISBN 978-0-7432-9979-4
- KAPLAN, Len and A. SMOLKIN, 2009. *Is Automotive Industry Dead or just stuck? Future Innovation for New Leaders in Car Transportation. Future Mapping Series Vol. II*.
- MINTO, Barbara, 2002. *The pyramid principle: logic in writing and thinking; [present your thinking so clearly that the ideas jump off the page and into the reader's mind]*. Second edition, published 2002. edition. London: Prentice Hall. ISBN 0-273-65903-0

Global Business and Economics 1 - Master	
Module abbreviation:	GBU_GBE1
Curriculum:	Programmes
	Global Business (GBU-M) - SPO-Nr.: 1
Responsible for module:	Gallier, Carlo
Lecturers:	Gallier, Carlo
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1: Global Business and Economics 1
Lecture types:	SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
1: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The course has four main objectives:</p> <p>Knowledge competencies</p> <p>1. Students will learn to apply economic theories to improve strategic decision-making in global business.</p> <p>Methodological competencies</p> <p>2. Students will leverage this knowledge to develop methodological competencies to analyze competitive environments in global markets.</p> <p>Personal competencies</p> <p>3. Students will apply their competencies to help themselves and others to make better decisions in complex business situations.</p> <p>Social competencies</p> <p>4. Students will apply their competencies to collaborate effectively within diverse and multicultural teams, contributing to the effectiveness of global markets.</p>	
Content:	
<p>We take an application-oriented approach to study global markets, with special emphasis on topics such as:</p> <ul style="list-style-type: none"> • firm behavior, competition, and efficiency • market power and collusion • market failure and regulation • emerging global challenges, such as climate change and inequality • corporate social responsibility • cross-cultural economics • international trade and investments • and many more if time permits 	

Literature:

- MANKIW, N. Gregory and Mark P. TAYLOR, 2023. *Economics*. Hampshire: Cengage.
- ACEMOGLU, Daron, David LAIBSON and John A. LIST, 2018. *Economics*.
- VELASQUEZ, Manuel G., 2013. *Business Ethics: Concepts and Cases*. Harlow: Pearson Education, Limited. ISBN 978-1-292-02281-9, 978-1-292-03601-4
- LÜTGE, Christoph, UHL, Matthias, 2021. *Business Ethics: An Economically Informed Perspective* [online]. Oxford, United Kingdom: Oxford University Press PDF e-Book. ISBN 978-0-19-189685-9. Available via: 20.500.12854/112311.

Global Business and Economics 2 - Master	
Module abbreviation:	GBU_GBE2
Curriculum:	Programmes
	Global Business (GBU-M) - SPO-Nr.: 5
Responsible for module:	Rauscher, Alois
Lecturers:	Rauscher, Alois
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	5: Global Business and Economics 2
Lecture types:	SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
5: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Students will learn to:</p> <p>Knowledge</p> <ul style="list-style-type: none"> understand the role of multinational corporations in the global economy. explain the determination of exchange rates and the international monetary system. describe the dynamics of the foreign exchange market. understand international debt and equity markets. explain the functions and impacts of international financial institutions, such as the IMF and WTO, on global trade and commerce. <p>Methodology</p> <ul style="list-style-type: none"> apply foreign exchange risk management techniques. assess and adapt global financial strategies in response to currency fluctuations and international market trends. conduct a country risk analysis. apply concepts related to capital budgeting and cross-border merger & acquisition management of a multinational corporation. <p>Personality</p> <ul style="list-style-type: none"> critically evaluate economic data to develop well-founded solutions during case study discussions. approach complex business problems with critical thinking and creative problem-solving skills. <p>Social Competence</p> <ul style="list-style-type: none"> collaborate effectively in multicultural teams to solve complex global business tasks. demonstrate intercultural communication skills to foster strong professional relationships. 	
Content:	
<ul style="list-style-type: none"> The role of multinational corporations in the global economy 	

- Corporate governance from a global perspective
- The determination of exchange rates and the international monetary system
- The foreign exchange market
- Foreign exchange risk management
- International debt and equity markets
- The impact of economic policies on global business and country risk analysis
- Capital budgeting for the multinational corporation
- Critical aspects regarding cross-border mergers and acquisitions

Literature:

- EUN, Cheol S., Bruce G. RESNICK and Tuugi CHULUUN, 2021. *International Financial Management*. New York: McGraw-Hill. ISBN 978-1-260-57531-6; 1-260-57531-4
- SHAPIRO, Alan C. and Paul HANOUNA, 2020. *Multinational Financial Management*. 11. edition. Hoboken: Wiley. ISBN 9781119559849

HR Management & Organisation	
Module abbreviation:	IG_HR&Orga
Curriculum:	Programmes
	International Management Bachelor (IG-B) - SPO-Nr.: 1
Responsible for module:	Lieske, Claudia
Lecturers:	Jahnke, Manja; Keller, Jochen; Lieske, Claudia; Wolfenstetter, Silke
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1.10: HR Management & Organisation
Lecture types:	1.10: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
1.10: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
Professional Expertise <ul style="list-style-type: none"> Students are familiar with the fundamentals and components of Human Resource (HR) Management and Organizational Management. They are familiar with the principles and foundations of personnel and organizational development, health management as well as aspects of international HR management. They have an overview of the fundamentals of German labor law. Methodological Expertise <ul style="list-style-type: none"> Students can assess the impact of current trends in HR Management and Organizational Management, such as demographic change, work-life balance, and virtualized work, on HR Management. They are able to solve case studies in German labor law. Social Skills <ul style="list-style-type: none"> Students can develop solutions to defined problems in small groups. Self-Competence <ul style="list-style-type: none"> Due to independently reviewing practical examples and case studies the students have analytical thinking and are able to apply the learned knowledge in practice-relevant situations. 	
Content:	
<ul style="list-style-type: none"> Areas of responsibility in HR Management and Organizational Management HR Marketing, Recruiting and Selection Basics of Organization Fundamentals of Personnel Development and Talent Management Leadership Compensation and Benefits 	

- Basics of HR Controlling
- Fundamentals of Individual Labor Law like Establishment and Structuring of Employment Relationships, Termination of Employment Relationships
- Fundamentals of Collective Labor Law (Collective Bargaining Agreement, Works Agreement)

Literature:

- DESSLER, Gary, 2023. *Human Resource Management*. Global edition, 17. edition. Upper Saddle River: Pearson Education Limited. ISBN 978-1-292-44979-1
- DOWLING, Peter, Allen ENGLE and Marion FESTING, 2023. *International Human Resource Management*. Andover: Cengage Learning. ISBN 978-1-4737-7379-0

International Accounting and Auditing	
Module abbreviation:	BW_UR5
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Jordan, Markus
Lecturers:	Jordan, Markus
Language of instruction:	English
Credit points / SWS:	6 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 103 h
	Total: 150 h
Subjects of the module:	2.3: International Accounting and Auditing
Lecture types:	2.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>2.3: LN - written exam, 90 minutes</p> <p>Additional Explanation:</p> <p>Voluntary acquisition of bonus points amounting to a maximum of 10% of the total exam score by means of an oral presentation in the course lasting a total of 15 minutes with accompanying slides.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>The students:</p> <ul style="list-style-type: none"> • are able to name all elements of external accounting according to HGB and IFRS and describe the corresponding preparation requirements according to HGB and IFRS • are familiar with the instruments of external accounting in accordance with HGB and IFRS for various balance sheet items • have the ability to recognise and design as well as analyse and criticise the scope for accounting policy in the preparation of annual financial statements • know the basics, tasks and methods of auditing as well as the general procedure for auditing financial statements • have practised the practical implementation of the acquired knowledge through case studies. 	
Content:	
<p>International Accounting</p> <ul style="list-style-type: none"> • Functions of (group) accounting • Overview of international accounting in accordance with IFRS • Overview of group accounting according to IFRS compared to HGB • Comparison of the IFRS balance sheet with the HGB balance sheet • Comparison of the income statement according to IFRS with the income statement according to HGB • Comparison of reporting in the notes according to IFRS and national accounting according to HGB • Segment reporting in accordance with IFRS • Statement of changes in equity in accordance with IFRS • Cash flow statement according to IFRS • Principles of external group accounting 	

Auditing

- Introduction to the fields of activity of an auditor and normative principles of auditing
- Professional principles and seal management
- Fundamentals of the risk-oriented audit approach
- Overview of the components of an audit
- Contents of the key audit statements in the audit report, audit opinion and meetings of the control bodies

Literature:

Compulsory:

- *International Financial Reporting Standards (IFRS), engl./deutsch, aktuelle Fassung (gebundene Ausgabe).*
- AMERICAN INSTITUTE OF CERTIFIED PUBLIC ACCOUNTANTS (AICPA), 1985. *Audits of small businesses.* New York: AICPA.

Recommended:

- AICPA (HRSG), *Journal of Accountancy* (<https://www.aicpa.org/resources/landing/journal-of-accountancy>).
- WIDYA AIS SAHLAA, NURUL QALBIAH, TINO KEMAL FATTAH, 2021. *The Audit Expectation Gap: How Can Auditing Teaching Mitigate It?*, in: *Indonesian Journal of Applied Accounting and Finance*, Vol. 1, No. 2(2021), 123-139.

International Business Diplomacy and Crosscultural Management	
Module abbreviation:	IG_IntBDCM
Curriculum:	Programmes
	International Management Bachelor (IG-B) - SPO-Nr.: 2
Responsible for module:	McDonald, James
Lecturers:	McDonald, James
Language of instruction:	English
Credit points / SWS:	6 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 103 h
	Total: 150 h
Subjects of the module:	2.8: International Business Diplomacy and Crosscultural Management
Lecture types:	2.8: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
2.8: seminar paper and presentation Additional Explanation: None	
Recommended prerequisites:	
Knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.	
Objectives:	
<p>The students</p> <ul style="list-style-type: none"> • know about the cultural differences and act accordingly • are able to interact and communicate in a global environment • are prepared to establish a business communication with international partners and are sensitive to their cultural peculiarities • are able to apply their knowledge in case studies in intercultural contexts and find appropriate solutions 	
Content:	
<ul style="list-style-type: none"> • Importance of intercultural management for companies doing business abroad • Theories of culture • Concepts of intercultural management and communication • Organisation and leadership in international teams • In-depth discussion of case studies on business in intercultural context 	
Literature:	
<ul style="list-style-type: none"> • HOFSTEDE, Geert, 2010. <i>Cultures and organizations: Software of the mind.</i> • TROMPENAARS, Fons and Charles HAMPDEN-TURNER, 2012. <i>Riding the waves of culture.</i> • <i>Weekly in-class discussions will be based on assigned readings. Texts will be added to Moodle throughout the semester to supplement and illustrate various points as necessary.</i> • RICHERSON, Peter J. and Robert BOYD, 2005. <i>Not by genes alone: how culture transformed human evolution.</i> Chicago [u.a.]: Univ. of Chicago Press. • INGLEHART, Ronald, 2018. <i>Cultural evolution: people's motivations are changing, and reshaping the world.</i> 	

- MOLL, Melanie, 2012. *The Quintessence of intercultural business communication*. Heidelberg u.a.: Springer.
- MEYER, Erin, 2014. *The Culture Map: Breaking Through the Invisible Boundaries of Global Business*.

International Business Simulation	
Module abbreviation:	IG_TOPSIM
Curriculum:	Programmes
	International Management Bachelor (IG-B) - SPO-Nr.: 2
Responsible for module:	Augsdörfer, Peter
Lecturers:	Augsdörfer, Peter; Sinha, Tanja
Language of instruction:	English
Credit points / SWS:	5 ECTS / 3 SWS
Workload:	Contact hours: 35 h
	Self-study: 90 h
	Total: 125 h
Subjects of the module:	2.13: International Business Simulation
Lecture types:	2.13: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>2.13: LN - seminar paper</p> <p>Additional Explanation:</p> <p>The course takes place virtually.</p> <p>PLEASE NOTE: Method of assessment / Requirements for Credit Points: LN: Game results and presentation of steps and strategies. Full attendance required. The course will be graded.</p> <p>Please note: as the seminar requires a minimum number of participants which is due to technical reasons of the simulation, a revision or reexamination cannot be offered in the summer term.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>The students will be able to</p> <ul style="list-style-type: none"> • understand thoroughly a global value chain process • experience the impact of positioning and strategic management on success • to interpret the factors influencing growth, sales, product development, production and finance • find out how to realize and control international economic connections • read and analyze budgets and reports as well as understand the financial structure of the global company • understand intercultural communication skills, team work, and work delegation 	
Content:	
<p>The business simulation (TOPSIM Going Global) has a global context. It is a sophisticated, computerized business simulation game. Together with fellow players, students simulate a management team, which is responsible for running a business in the washing machine industry. The objective of the game is to train students to acquire general management skills and an overall view of management combined with cultural elements of an imaginary international corporation.</p>	
Literature:	
<ul style="list-style-type: none"> • <i>Simulation Game Handbook (will be provided).</i> • <i>Following literature for further reference will be announced during class.</i> 	

International Economics							
Module abbreviation:	GBM_IE						
Curriculum:	Programmes						
	Global Economics and Business Management (GBM-B) - SPO-Nr.: 2						
Responsible for module:	Schauberger, Katharina						
Lecturers:	Schauberger, Katharina						
Language of instruction:	English						
Credit points / SWS:	6 ECTS / 4 SWS						
Workload:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding-left: 20px;">Contact hours:</td> <td style="text-align: right;">47 h</td> </tr> <tr> <td style="padding-left: 20px;">Self-study:</td> <td style="text-align: right;">103 h</td> </tr> <tr> <td style="padding-left: 20px;">Total:</td> <td style="text-align: right;">150 h</td> </tr> </table>	Contact hours:	47 h	Self-study:	103 h	Total:	150 h
Contact hours:	47 h						
Self-study:	103 h						
Total:	150 h						
Subjects of the module:	2.1: International Economics						
Lecture types:	SU/Ü - lecture with integrated exercises The course can take place either partially or entirely in a virtual format. Further information can be found in the timetable and/or will be provided by the lecturer.						
Studien- / Prüfungsleistungen:							
2.1: schrP90 - written exam, 90 minutes Additional Explanation: None							
Recommended prerequisites:							
Knowledge of 1.2 Microeconomics and 1.6 Macroeconomics is recommended. An in-depth study of literature is also highly recommended.							
Objectives:							
<p>Students:</p> <ul style="list-style-type: none"> • can provide different theoretical explanations of international trade. • are able to discuss the limitations and practical relevance of these explanations. • can locate the respective gains and losses of trade. • can describe different internationalization strategies of firms. • are able to explain the existence of trade barriers and identify their effects on welfare. • manage to explain the structure and functions of the foreign exchange market. • can apply an asset market approach to exchange rate determination. • can explain how monetary shifts affect the equilibrium exchange rate in the short run and the long run 							
Content:							
<ul style="list-style-type: none"> • The Ricardian Model • The Heckscher-Ohlin Model • Firms in the Global Economy • Trade Policy Instruments • An Asset Market Approach to Exchange Rate Determination • Money, Interest Rates, and Exchange Rates 							
Literature:							
<ul style="list-style-type: none"> • KRUGMAN, Paul R., Maurice OBSTFELD and Marc J. MELITZ, 2018. <i>International economics: theory and policy</i>. 11. edition. Harlow, England: Pearson. ISBN 978-1-292-21494-8 							

- FEENSTRA, R. C. and A.M. TAYLOR, 2021. *International Economics*.

Internationalization in Retailing - Master	
Module abbreviation:	RCM_IR_1.3 Ind. Elective
Curriculum:	Programmes
	Retail und Consumer Management (RCM-M) - SPO-Nr.: 1
Responsible for module:	Isakulov, Temurbek
Lecturers:	Isakulov, Temurbek
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1.3: Internationalization in Retailing
Lecture types:	1.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
1.3: project report. Seminar work. Written composition approx. 10-15 pages with presentation 15-30 minutes.	
Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
Subject competence	
<ul style="list-style-type: none"> • Demonstrate knowledge of legal frameworks and compliance requirements in international business. • Are familiar with the reasons for, objectives, forms, chances and threats of going and being international in business. • Know how to deal theoretically and practically with various factors that impact the process of internationalizing and measures which could be used to handle the same. • Know selected instruments and strategies for the design and further development of an international concept. • Practical implementation of market analysis on key areas. • Know the strategic implications for cultural analysis, political and economic systems. • Know specific features, problems and characteristic traits of international business in a problem-orientated way. • Can identify current trends shaping globalization and internationalization with their managerial implications. 	
Methodological competence	
<ul style="list-style-type: none"> • Create actionable business reports and dashboards for presentation at the upper-management level. • Use case studies to exercise contents learned. • Apply the tools and concepts of internationalization. 	
Personal/Self-competence	
<ul style="list-style-type: none"> • Show confidence in handling ambiguity and complex decision-making scenarios on a global scale. 	
Social competence	
<ul style="list-style-type: none"> • Develop relationships with stakeholders across different global markets. 	

Content:

International Trends

- Development of branded environments
- Technical aspects and sustainable aspects.
- International Experience

Development, relevance & dimensions of internationalization in business

- Strategies and instruments
- Chances and threats
- Case studies

Literature:

- KONINA, Natalia, 2021. *Digital strategies in a global market: navigating the fourth industrial revolution* [online]. Cham: Palgrave Macmillan PDF e-Book. ISBN 978-3-030-58267-8. Available via: <https://doi.org/10.1007/978-3-030-58267-8>.
- FUCHS, Manfred, 2022. *International Management: The Process of Internationalization and Market Entry Strategies* [online]. Berlin: Springer Gabler PDF e-Book. ISBN 978-3-662-65870-3. Available via: <https://doi.org/10.1007/978-3-662-65870-3>.
- CHRAUTWALD SORT, Jesper and others, 2025. *De-internationalization and Re-internationalization of the Firm: Business Innovation for Growth and Survival*. Cham: Springer Nature Switzerland AG. ISBN 978-3-031-81773-1
- ROMERO, Elena Domínguez and others, 2023. *Rethinking internationalization processes: toward a circular framework*. 18, 3363–3394 [online]. PDF e-Book. ISBN ISSN 1863-6691. Available via: <https://doi.org/10.1007/s11846-023-00719-9>.

International Marketing							
Module abbreviation:	BW_MS6						
Curriculum:	Programmes						
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2						
Responsible for module:	Gupta, Shipra						
Lecturers:	Gupta, Shipra						
Language of instruction:	English						
Credit points / SWS:	6 ECTS / 4 SWS						
Workload:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding-left: 20px;">Contact hours:</td> <td style="text-align: right;">47 h</td> </tr> <tr> <td style="padding-left: 20px;">Self-study:</td> <td style="text-align: right;">103 h</td> </tr> <tr> <td style="padding-left: 20px;">Total:</td> <td style="text-align: right;">150 h</td> </tr> </table>	Contact hours:	47 h	Self-study:	103 h	Total:	150 h
Contact hours:	47 h						
Self-study:	103 h						
Total:	150 h						
Subjects of the module:	2.3: International Marketing						
Lecture types:	2.3: SU/Ü - lecture with integrated exercises						
Studien- / Prüfungsleistungen:							
<p>2.3: LN - written exam, 90 minutes</p> <p>Additional Explanation:</p> <p>This course will be taught using lectures and discussions of the various areas of international marketing. When possible, these sessions will be supported by documentaries/videos and in-class activities.</p> <p>This course will be taught using lectures and discussions of the various areas of international marketing. When possible, these sessions will be supported by documentaries/videos and in-class activities. An extra credit of maximum 10% of the total exam points can be obtained by doing a presentation.</p>							
Recommended prerequisites:							
None							
Objectives:							
<p>The students develop the capacity to:</p> <ul style="list-style-type: none"> • Understand and critically assess external factors affecting international marketing. These factors are related to the economic, social, cultural, political, legal and competitive environments. • Understand how to develop a global marketing strategy and specific marketing plans that effectively reduce risk and take advantage of opportunities in the marketplace of the world. <p>Subject Competencies</p> <ul style="list-style-type: none"> • Analyze the international marketing environment by evaluating economic, social, cultural, political, legal, and competitive factors that influence marketing decisions. • Understand the balance between standardization and adaptation in global marketing strategies to effectively manage international market challenges. • Assess risks and opportunities in diverse global markets to support informed strategic decision-making. <p>Methodological Competencies</p> <ul style="list-style-type: none"> • Develop global marketing strategies and specific plans that apply the principles of standardization and adaptation to real-world international marketing scenarios. • Apply analytical and strategic thinking to identify, assess, and solve international marketing problems. • Integrate market data and environmental factors to make informed international marketing decisions. <p>Personal Competencies</p> <ul style="list-style-type: none"> • Exercise critical judgment in evaluating global market conditions and marketing strategies. • Demonstrate independent decision-making in planning and executing international marketing actions. • Develop adaptability to navigate the complexities of multicultural and multinational business contexts. 							

Social Competencies

- **Communicate international marketing strategies and recommendations effectively** to diverse audiences.
- **Collaborate in team-based analyses and projects** addressing global marketing problems.
- **Respect cultural diversity** when interacting with peers and stakeholders in international contexts.

Content:

- Students know the background for making marketing decisions in the international business environment and have to develop their capacity to assess and solve international marketing problems.
- the students become familiar with the issue of “standardization versus adaptation”, a dilemma that is central to most international marketing decisions. A successful international marketing strategy is based on a right balance between preserving versus adapting the aspects of the marketing strategy used in the domestic market.

Literature:

- KOTABE, Masaaki and Kristiaan HELSEN, 2020. *Global marketing management*. Hoboken: Wiley. ISBN 978-1-119-56311-2, 978-1-119-60350-4
- In: *Students will also be expected to read current news. The best sources for keeping up with news relevant to international marketing are The Wall Street Journal, The Economist, Business Week, and The Financial Times.*

International Strategic Management	
Module abbreviation:	IG_Strat
Curriculum:	Programmes
	International Management Bachelor (IG-B) - SPO-Nr.: 2
Responsible for module:	Jünger, Michael
Lecturers:	Jünger, Michael; Schmidt, Karin
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	2.7: International Strategic Management
Lecture types:	2.7: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>2.7: schrP90 - written exam, 90 minutes</p> <p>Additional Explanation:</p> <p>The course will take part in two 2 hour sessions per week, both slots need to be attended in order to pass the course.</p> <p>This course cannot be chosen in combination with the course "Strategic Management" (Betriebswirtschaft degree program).</p>	
Recommended prerequisites:	
<p>The students should have a basic knowledge of mathematics, international accounting and cost accounting. Knowledge beyond the university entrance qualification is not required. An intense study of literature is highly recommended.</p>	
Objectives:	
<p>Professional competence</p> <p>The students are able to...</p> <ul style="list-style-type: none"> • explain the purpose, scope and relevance of strategic management in organizations. • describe and differentiate corporate-level, business-level and functional-level strategies. • analyze industry structures, competitive positions and strategic challenges using established strategic management frameworks. • evaluate strategic options with regard to competitive advantage, value creation and long-term performance. <p>Methodological competence</p> <p>The students are able to...</p> <ul style="list-style-type: none"> • apply instruments of strategic analysis and strategy design to practical business cases and entrepreneurial ideas. • structure and develop coherent strategic concepts by integrating external analysis, internal resources and strategic objectives. • assess strategic decisions and their implications under conditions of uncertainty and limited information. <p>Personal / self-competence</p> <p>The students are able to...</p> <ul style="list-style-type: none"> • reflect on their own strategic reasoning and decision-making processes. • work independently on complex strategic tasks and manage their learning process responsibly. 	

Social competence

The students are able to...

- work effectively in teams when developing and discussing strategic concepts.
- communicate strategic analyses and recommendations clearly and convincingly in written and oral form.

Content:

This module provides an application-oriented introduction to strategic management by combining conceptual foundations, analytical tools and practical examples.

Key topics include:

- Introduction to strategic management and executive decision-making.
- Strategy and management in dynamic and competitive markets.
- Levels of strategy: corporate, business and functional strategies.
- External analysis: industry structures, competitive forces and market developments.
- Internal analysis: resources, capabilities and core competencies.
- Competitive advantage and business model design.
- Strategy design innovation approaches and analytical toolsets.
- Strategy formulation in different industry and market contexts.
- Strategy implementation, execution and performance management.
- Case studies and applied group work based on business or entrepreneurial ideas

Literature:

- JÜNGER, Michael and others, 2024. *Strategy design innovation: how to create business success using a systematic toolbox*. Completely revised 6. edition. Augsburg: ZIEL. ISBN 978-3965571358
- GRANT, Robert M., 2025. *Contemporary strategy analysis*. Hoboken, NJ: Wiley. ISBN 978-1-394-25159-9
- LYNCH, Richard L. and others, 2024. *Strategic management*. 10. edition. London: Sage. ISBN 978-1-5296-7255-8, 978-1-5296-7256-5
- HILL, Charles W. L., Melissa A. SCHILLING and Gareth R. JONES, 2024. *Strategic management: an integrated approach: theory & cases*. 14. edition. Boston, MA: Cengage. ISBN 978-0-357-71662-5

International Sustainability Management	
Module abbreviation:	NW_ISM
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Warrings, Vincent
Lecturers:	Warrings, Vincent
Language of instruction:	English
Credit points / SWS:	3 ECTS / 2 SWS
Workload:	Contact hours: 23 h
	Self-study: 52 h
	Total: 75 h
Subjects of the module:	2.1.10: International Sustainability Management
Lecture types:	2.1.10: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
2.1.10: LN - seminar paper Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Professional competence The students are able to...</p> <ul style="list-style-type: none"> • explain key concepts, frameworks, and debates in international sustainability management. • describe the role of multinational enterprises in addressing social, environmental, and ethical challenges. • analyze sustainability-related issues in different institutional contexts. • evaluate organizational approaches to sustainability from a business and societal perspective. <p>Methodological competence The students are able to...</p> <ul style="list-style-type: none"> • apply basic principles of academic research to sustainability-related topics. • develop a structured analytical argument based on academic literature. • identify research gaps and derive meaningful proposals for further research. • translate theoretical insights into a clear and coherent presentation. <p>Personal / self-competence The students are able to...</p> <ul style="list-style-type: none"> • reflect critically on their own assumptions regarding business responsibility and sustainability. • work independently on complex analytical tasks and manage their learning process responsibly. • assess their own academic performance and identify areas for improvement. <p>Social competence The students are able to...</p> <ul style="list-style-type: none"> • present sustainability-related topics clearly and in a structured manner. • engage constructively in academic discussions and respond to critical questions. • provide respectful and constructive feedback to peers. 	

Content:

Course design and assignments

During the first session, students receive a brief description of the different topics available to work on during the block class. The individual selection of the topic takes place during the first week on Moodle.

Each topic should be explored in the context of a specific real case study. Proposed topics are provided, and some readings per topic are suggested to get students started on their research. Students are expected to do an additional literature search and review concerning the topic selected for their paper assignment.

During the sessions in the first week, the lecturer will make some introductory theoretical presentations and provide advice on presentation skills and the case study research methodology. When presentation sessions for students initiate, the lecturer will make small introductory theoretical presentations or writing development workshops; afterwards, students make their presentations. Students' presentations are no longer than 30 minutes, including (1) a theoretical part and (2) the presentation of the case study so that ample time is left for questions and discussion (a maximum of 45 minutes per topic). Every student will be individually evaluated, even if working groups are built.

Based on a 360 degrees approach to skills development, students will be actively involved in the development of presentation skills. For that reason:

- Students will provide feedback on their colleague's presentations after every session
- Students will reflect and evaluate the outcome of their presentation using a self-assessment instrument
- Besides, the lecturer will provide feedback to every presenter

With the input received during the presentation and with the results of the case discussion, students prepare their term paper that includes a theoretical part and a case study part. It is suggested to use the case study research method for the development of the paper. However, the methodology will be discussed with the lecturer based on the research question proposed. Further guidance for writing the term paper and preparing presentations will be provided during the first sessions and the website for the course on Moodle.

Literature:

- FREEMAN, R., B. PARMAR and K. MARTIN, 2020. *The Power of And: Responsible Business Without Trade-Offs*. West Sussex: Columbia University Press. ISBN 9780231188500
- SERAFEIM, G., 2022. *Purpose + Profit: How Business Can Lift Up the World*. New York: HarperCollins Leadership. ISBN 9781400230358
- YIN, R., 2018. *Case Study Research: Design and Methods*. Washington DC: Melbourne: SAGE. ISBN 9781506336169

Leading in International Retail Organizations - Master	
Module abbreviation:	RCM_LIRO_1.3 Ind. Elective
Curriculum:	Programmes
	Retail und Consumer Management (RCM-M) - SPO-Nr.: 1
Responsible for module:	Robichaud, Zachary
Lecturers:	Robichaud, Zachary
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1.3: Leading in International Retail Organizations
Lecture types:	1.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
1.3: project report. Practical work. Written composition approx. 10-15 pages with presentation 15-30 minutes.	
Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
Subject competence	
<ul style="list-style-type: none"> • Develop advanced knowledge of human resource management and organizational behaviour within global retail organizations, with a particular focus on Canada and the United States. • Understand cross-cultural workforce dynamics, multinational HR challenges, and the implications of legal, cultural, and institutional differences in retail contexts. • Apply evidence-based HR practices related to talent management, performance management, DEI strategies, organizational culture, and change management in international retail firms. • Interpret and apply insights from the Lumina Learning framework to understand leadership preferences, communication styles, and behavioural tendencies in retail organizations. • Integrate academic theory with real-world retail cases and industry partner challenges, demonstrating subject-matter expertise relevant to contemporary global retail environments. 	
Methodological competence	
<ul style="list-style-type: none"> • Analyze complex organizational and HR challenges using structured frameworks and evidence-based reasoning. • Apply case study analysis, experiential learning tools, and reflective diagnostics (e.g., Lumina Learning outputs) to assess leadership and team dynamics. • Conduct collaborative applied research through an industry-based group project, translating theory into actionable HR and organizational recommendations. • Develop professional written and oral communication skills, including the preparation of industry-facing reports and formal presentations to an employer partner. • Demonstrate the ability to synthesize qualitative insights (e.g., leadership styles, culture, DEI practices) with practical organizational constraints in global retail contexts. 	
Personal/Self-competence	

- Increase self-awareness of leadership styles, behavioural tendencies, and communication preferences through the Lumina Learning assessment and facilitated debrief.
- Reflect critically on their own strengths, blind spots, and leadership development needs in diverse and fast-paced retail environments.
- Develop ethical judgment, resilience, and adaptability when navigating ambiguity, change, and complexity in global organizations.
- Strengthen their capacity for lifelong learning, self-reflection, and continuous professional growth as future retail leaders.
- Build confidence in translating personal insights into practical leadership strategies applicable to real-world retail settings.

Social competence

- Demonstrate the ability to lead and collaborate effectively in diverse, cross-cultural teams, both in academic and industry-facing contexts.
- Develop intercultural communication competence, including empathy, cultural sensitivity, and the ability to manage differences constructively.
- Practice professional teamwork, conflict navigation, and collective decision-making through in-class activities and group-based projects.
- Engage with external stakeholders and employer partners, adapting communication styles to different professional audiences.
- Foster inclusive leadership behaviours aligned with diversity, equity, and inclusion (DEI) principles in global retail organizations.

Content:

Modules

1. Leadership & Teamwork
2. Motivation & Operational Strategies
3. Coaching & Feedback
4. Organizational Culture & Employee Engagement
5. Employer & Self-Branding
6. Managing Conflict & Difficult Situations
7. Demographics & The Changing Society – How to Manage Diverse Teams

Literature:

Will be announced at course start.

Marketing	
Module abbreviation:	BW_Mark
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 1
Responsible for module:	März, Marco
Lecturers:	März, Marco; Thanekar, Gaurang
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1.13: Marketing
Lecture types:	SU - lecture
Studien- / Prüfungsleistungen:	
1.13: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
Es sind keine über das (Fach-)Abitur hinausgehende Kenntnisse erforderlich. Ein intensives Literaturstudium (s.u. Literaturangaben) ist notwendig.	
Objectives:	
<p>The students</p> <p>Subject Competence:</p> <ul style="list-style-type: none"> • are able to explain the fundamental nature, functions, and basic principles of marketing and sales. • can evaluate and explain positioning and differentiation strategies in market contexts. • are able to identify, describe, and apply the key elements of the marketing mix. • are able to develop and evaluate product strategies and branding concepts. • can design and analyze pricing strategies and programs in various market contexts. • are capable of developing and managing integrated marketing channel strategies. <p>Methodological Competence:</p> <ul style="list-style-type: none"> • can analyze and describe strategic planning processes in companies with a focus on marketing and sales as a market-driven philosophy. • are capable of applying marketing research processes to analyze both broad and specific marketing environments of companies. • are competent in developing and evaluating strategic marketing and sales concepts, including market analysis, segmentation, and targeting. • can formulate and assess integrated marketing communication strategies and programs. <p>Personal/Self-Competence:</p> <ul style="list-style-type: none"> • are able to work independently on marketing case studies and best practices. <p>Social Competence:</p> <ul style="list-style-type: none"> • can analyze and solve complex marketing and sales problems through case study applications. • can communicate marketing strategies to stakeholders. 	

Content:

- 1** Strategic Marketing and Sales
 - 1.1 Marketing for the 21st Century
 - 1.2 Developing Marketing Strategies and Plans
 - 1.3 Collecting Information and Forecasting Demand
 - 1.4 Competitive Dynamics
 - 1.5 Analyzing Consumer Markets
 - 1.6 Identifying Market Segments and Targets, Positioning
10. Operative Marketing and Sales
 - 2.1 Product Strategy and Branding
 - 2.2 Developing Pricing Strategies and Programs
 - 2.3 Designing and Managing Integrated Marketing Channels
 - 2.4 Developing Communication Strategies and Programs

Literature:

- KOTLER, Philip, Kevin Lane KELLER and Alexander CHERNEV, 2022. *Marketing management*. 16. edition. Harlow, England: Pearson. ISBN 978-1-292-40481-3
- BECKER, Jochen, 2019. *Marketing-Konzeption: Grundlagen des ziel-strategischen und operativen Marketing-Managements* [online]. München: Verlag Franz Vahlen PDF e-Book. ISBN 978-3-8006-5760-5. Available via: <https://doi.org/10.15358/9783800657605>.
- KOTLER, Philip and others, 2023. *Marketing-Management: Konzepte - Instrumente - Unternehmensfallstudien*. 16. edition. München: Pearson. ISBN 978-3-86894-443-3, 3-86894-443-5

Methods & Instruments of Strategic Controlling	
Module abbreviation:	BW_CF6
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Schmidt, Karin
Lecturers:	Schmidt, Karin
Language of instruction:	English
Credit points / SWS:	6 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 103 h
	Total: 150 h
Subjects of the module:	2.3: Methods & Instruments of Strategic Controlling
Lecture types:	2.3: SU/Ü - seminaristischer Unterricht/Übung
Studien- / Prüfungsleistungen:	
<p>2.3: LN - written exam, 90 minutes</p> <p>Additional Explanation:</p> <p>The course will require students to actively prepare themselves for the sessions by studying short prereads of relevant articles which are taken from the recent press. They will be discussed in class.</p> <p>Voluntary bonus point program available: students can acquire an additional 10% (i.e. 9 points) on top of the 90 points for the exam by preparing a 5-10 minute video plus slides on a given topic during the semester. Deadline for hand-in in SS26: Friday 12/06/26</p>	
Recommended prerequisites:	
Ein intensives Literaturstudium (s.u. Literaturangaben) ist notwendig.	
Objectives:	
<p>Students:</p> <ul style="list-style-type: none"> • are able to correctly define and explain the concepts of strategic controlling and its differences to strategic management • detect opportunities and boundaries relating to strategic controlling • can evaluate different instrument and tools of strategic controlling in companies • know different future scenario concepts and are able to creatively develop their own strategic options for companies • are capable to assess the application possibilities of the formentioned instruments in practice <p>The following AOL Learning Objectives are emphasized:</p> <ul style="list-style-type: none"> • Attitude of Responsibility • Spirit of Creativity and Entrepreneurial Thinking • Business Competence • Application Strength 	
Content:	
<ul style="list-style-type: none"> • Definition and distinction of strategic controlling and strategic management as well as operational controlling • Instruments and tools of Strategic Controlling (e.g. SWOT analysis, risk management systems) and their practical relevance • Different future trend scenarios (e.g. megatrend theory, club of Rome, transformation theory) • Effects of sustainability and digitalization on companies and their role in controlling 	

Literature:

- DAVID, Fred R., Forest R. DAVID and Meredith E. DAVID, 2023. *Strategic management: concepts and cases: a competitive advantage approach*. Harlow, England: Pearson. ISBN 978-1-292-44140-5, 1-292-44140-2
- BAUM, Heinz-Georg, Alfred COENENBERG and Thomas GÜNTHER, 2013. *Strategisches Controlling*. Stuttgart: Schäffer-Poeschel.
- ALTER, Roland, 2019. *Strategisches Controlling*. München: deGruyter Oldenbourg. ISBN 978-3-11-058444-8

Modern Leadership - Master	
Module abbreviation:	GBU-ML
Curriculum:	Programmes
	Global Business (GBU-M) - SPO-Nr.: 7
Responsible for module:	Hackl, Oliver
Lecturers:	Hackl, Oliver
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	7: Modern Leadership
Lecture types:	SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
7: mdIP - oral exam, 15 minutes Additional Explanation: None	
Recommended prerequisites:	
Basic knowledge in HR management and leadership.	
Objectives:	
At the end of the course, the students	
Knowledge	
<ul style="list-style-type: none"> understand the changing nature of leadership in the global new normal. 	
Methodology	
<ul style="list-style-type: none"> use advanced negotiation and decision-making models to resolve cross-border business conflicts. apply advanced leadership frameworks and decision-making models to solve complex challenges in global organizations. 	
Personality	
<ul style="list-style-type: none"> foster adaptability and resilience to navigate leadership challenges in volatile, uncertain, complex, and ambiguous (VUCA) global settings. 	
Social Competence	
<ul style="list-style-type: none"> build, motivate and manage high-performance teams in a fast changing and increasingly digitized world. correspondingly lead change and innovation in global organizations. listen actively and adapt communication styles to diverse team dynamics. 	
Content:	
<ul style="list-style-type: none"> Introduction to Modern Leadership in the New Normal Adapting Leadership Styles for the New Normal Organizational Behavior and Decision Making Motivating and Engaging High-Performance Teams Effective Communication & Coaching Embracing Change and (Digital) Transformation in Leadership Leading in the Midst of Chaos, Crisis and Uncertainty Cultivating Diversity, Equity and Inclusion in Leadership 	

- Ethical and Emotional Leadership in the New Normal
- Nurturing Innovation and Creativity in Leadership
- The Future of Leadership: Trends and Emerging Practices
- Overview of the Oral Exam Format, including the Structure, Duration, and Assessment Criteria

Literature:

- KAHNEMAN, Daniel, 2012. *Thinking, fast and slow*. [London]: Penguin Books. ISBN 978-0-141-03357-0, 0-141-03357-6
- GOLEMAN, Daniel, Richard E. BOYATZIS and Annie MCKEE, 2004. *Primal leadership: learning to lead with emotional intelligence*. Boston, Mass.: Harvard Business School Press. ISBN 978-1-59139-184-5, 1-59139-184-9
- ALSUWAIDI, Faisal and CHATGPT, 2023. *Beyond the Horizon: Uncharted Territories in Modern Leadership*. ISBN 979-8389502468
- CULBERTSON, Lloyd and Michael Scott PARKS, 2023. *Leadership Today. How to Harness The Power Of Modern Leadership Practices*. ISBN 979-8386384081

Pop-up Retail Strategies in an Omnichannel Context - Master	
Module abbreviation:	RCM_PRSOC_1.3 Ind. Elective
Curriculum:	Programmes
	Retail und Consumer Management (RCM-M) - SPO-Nr.: 1
Responsible for module:	Yu, Hong
Lecturers:	Yu, Hong
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1.3: Pop-up Retail Strategies in an Omnichannel Context
Lecture types:	1.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
1.3: project report. Seminar work. Written composition approx. 10-15 pages with presentation 15-30 minutes.	
Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>The primary objective of this course is to move past the marketing hype of pop-up shops and analyze them as a legitimate, complex distribution channel. We want students to critically evaluate how temporary retail integrates with a broader omnichannel strategy, questioning whether these activations drive actual long-term value or just fleeting engagement. Beyond the creative concept, students will need to master the rigorous logistics of short-term leasing and inventory management while dissecting the consumer psychology of scarcity. Ultimately, the objective is to produce graduates who can determine when a temporary physical presence is a smart strategic move and when it is simply a drain on resources.</p> <p>At the end of the course, the students will be able to achieve the following:</p>	
Subject competence	
<ul style="list-style-type: none"> • Strategic Viability: Evaluate pop-up retail not merely as a trend, but as a distinct distribution channel, analyzing where it succeeds and where it fails compared to permanent leases. • Lifecycle Economics: Deconstruct the cost structures specific to temporary retail, questioning the profitability of short-term activations when weighed against setup and teardown costs. • Logistical Agility: Understand the unique supply chain requirements for temporary spaces, specifically how to manage inventory depth without the safety net of a long-term warehouse strategy. • Legal and Real Estate Dynamics: Analyze the shifting power dynamics between tenants and landlords, focusing on how short-term leases disrupt traditional commercial real estate models. 	
Methodological competence	
<ul style="list-style-type: none"> • Metric Definition: Develop frameworks to measure success when immediate sales volume is not the primary KPI, such as quantifying brand lift, customer acquisition costs, or data harvesting. • Agile Project Management: Apply rapid deployment methodologies to retail planning, demonstrating the ability to execute a concept from ideation to launch in compressed timeframes. 	

- **Site Selection Analysis:** Utilize non-traditional criteria for location scouting, learning to identify high-potential spaces that traditional long-term retailers would overlook.
- **Experience Design:** Create retail layouts that prioritize high-throughput customer engagement over traditional stock density, using the constraints of the space to force creative merchandising.

Personal/Self-competence

- **Risk Assessment:** Cultivate a realistic understanding of the risks involved in "here today, gone tomorrow" retail, moving beyond the glamour of the launch to the reality of operational instability.
- **Sustainability Reflection:** Critically examine the environmental impact of the pop-up model, questioning the waste generated by temporary fixtures and single-use marketing materials.
- **Adaptability:** Develop the resilience to handle the inevitable operational failures that occur when infrastructure is temporary and untested.

Social competence

- **Stakeholder Negotiation:** Learn to advocate for the validity of temporary concepts to skeptical stakeholders, including risk-averse landlords and corporate finance teams.
- **Community Impact:** Analyze the role of pop-up retail in neighborhood gentrification, discussing whether these temporary spaces serve the local community or merely test it for corporate expansion.
- **Collaborative Execution:** Manage the friction inherent in cross-functional teams (design, ops, marketing) when working under the extreme pressure of a hard launch deadline.

Content:

- **The Evolution of Ephemeral Retail:** We start by tracing the history of the format, moving away from the idea of pop-ups as just a solution for high vacancy rates and framing them as a deliberate, strategic response to the "retail apocalypse" and the saturation of e-commerce.
- **Typologies and Formats:** We break down the different models—nomadic stores, parasitic (store-within-a-store) setups, and standalone temporary leases—analyzing which format works for specific brand stages (start-up vs. legacy).
- **Omnichannel Integration:** This is the core strategic piece. We look at how the physical pop-up serves as a customer acquisition tool for the digital channel, focusing on the "halo effect" where a temporary physical presence drives long-term online traffic in that region.
- **The Psychology of Scarcity:** We examine the consumer behavior driving this trend, specifically how "Fear Of Missing Out" (FOMO) and the hunt for exclusivity can be operationalized to drive foot traffic and immediate conversion.
- **Operational Logistics and Agility:** We get into the weeds of supply chain management for short lifecycles. This covers the unique challenges of inventory depth, rapid staffing, and the logistical headache of setting up and tearing down infrastructure without a permanent support system.
- **Location Strategy and Real Estate:** We analyze the changing landlord-tenant relationship, looking at how to negotiate short-term leases and identify non-traditional spaces that offer high visibility but low commitment.
- **Experience Design and Technology:** We explore how to design for "moments" rather than just transactions. This includes the integration of tech for data capture—using the pop-up as a lab to test new products or gather customer data before a wider rollout.
- **Measuring Success Beyond Sales:** We redefine the KPIs. Since these stores often operate at a loss on a pure P&L basis, we focus on measuring media value, brand lift, customer data acquisition, and social engagement.

Literature:

- YU, H., SEDLEZKY, S., WONG, K. K.-K, HERNANDEZ, T., STEVENSON, G., LARSEN, P., 2018. *Pop-up retail strategies in an omnichannel context* [online]. Ontario: eCampus PDF e-Book. ISBN This is an open etextbook that students can download for free.. Available via: <https://pressbooks.library.torontomu.ca/popup>.

Retail Business Modelling - Master	
Module abbreviation:	RCM_RBM_1.3 Ind. Elective
Curriculum:	Programmes
	Retail und Consumer Management (RCM-M) - SPO-Nr.: 1
Responsible for module:	Marques, Thiago
Lecturers:	Marques, Thiago
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 79 h
	Total: 126 h
Subjects of the module:	1.3: Retail Business Modelling
Lecture types:	SC / E: seminar course with exercises
Studien- / Prüfungsleistungen:	
<p>1.3: project report. Seminar work. Written composition approx. 10-15 pages with presentation 15-30 minutes.</p> <p>Additional Explanation:</p> <p>Students are required to work on a paper which is graded and presented in class. This course requires a higher individual workload to fulfill the project requirements. Approximately 50% of the course is lecturer-led. The other 50% is additional workload for the preparation of the project work.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>This course aims to provide students with a structured and strategic understanding of retail business models, using the Business Model Canvas as the primary analytical and design framework. Students will learn how to deconstruct, analyze, and redesign retail organizations across physical, digital, and omnichannel environments, connecting value creation with operational, financial, and customer dimensions.</p> <p>By the end of the course, students will be able to design, validate, and iterate retail business models aligned with market dynamics, technological innovation, and evolving consumer behavior. The course emphasizes the integration of strategic thinking, experimentation logic, and execution discipline in retail contexts.</p> <p>Subject competence:</p> <ul style="list-style-type: none"> Analyze retail companies using the nine building blocks of the Business Model Canvas. Identify value proposition alignment with specific retail customer segments. Evaluate revenue models, cost structures, and margin logic in retail operations. Understand omnichannel dynamics and ecosystem partnerships in retail. Assess scalability and competitive advantage in retail business models. <p>Methodological competence:</p> <ul style="list-style-type: none"> Apply the Business Model Canvas as a diagnostic and design tool. Use hypothesis-driven experimentation inspired by Lean Startup principles. Structure customer discovery and validation processes in retail contexts. Develop data-informed decisions regarding pricing, channels, and assortment strategies. Prototype and test retail concepts using rapid iteration frameworks. <p>Personal/Self-competence:</p>	

- Strategic thinking and systemic vision.
- Entrepreneurial mindset and experimentation tolerance.
- Analytical rigor in decision-making.
- Adaptability in dynamic market environments.
- Ownership and accountability in business model design.

Social competence:

- Cross-functional collaboration skills.
- Ability to communicate business models clearly and persuasively.
- Negotiation skills with partners and stakeholders.
- Leadership in innovation and transformation processes.
- Constructive feedback and peer evaluation capabilities.

Content:

The course is structured around the nine building blocks of the Business Model Generation framework. First, students explore Customer Segments, Value Proposition, and Channels, analyzing how retail companies define target audiences, craft differentiated offerings, and design customer journeys across physical and digital touchpoints. Special attention is given to customer experience design, assortment strategy, and omnichannel integration.

Second, the course examines Customer Relationships and Revenue Streams, focusing on loyalty models, subscription formats, dynamic pricing, marketplace structures, and data monetization. Students evaluate how retailers capture value while sustaining long-term customer engagement.

Third, the operational backbone is analyzed through Key Resources, Key Activities, and Key Partnerships. Topics include supply chain management, inventory optimization, private label strategies, technology infrastructure, and ecosystem collaboration (logistics providers, marketplaces, fintech partners).

Finally, students study Cost Structure, connecting fixed vs. variable costs, contribution margin logic, store economics, digital platform scalability, and capital allocation decisions. The course culminates in the design and presentation of an innovative retail business model validated through Lean Startup experimentation cycles.

Literature:

- OSTERWALDER, A. and Y. PIGNEUR, 2010. *Business Model Generation: A handbook for visionaries, game changers, and challengers*. Hoboken, NJ: John Wiley & Sons.
- RIES, E., 2011. *The Lean Startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. New York, NY: Crown Business.

Retail Lab: Consumer Projects and Project Management - Master	
Module abbreviation:	RCM_CPPM
Curriculum:	Programmes
	Retail und Consumer Management (RCM-M) - SPO-Nr.: 1
Responsible for module:	Knoppe, Marc
Lecturers:	Knoppe, Marc
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	1.1: Retail Lab: Consumer Projects and Project Management
Lecture types:	SC / E: seminar course with exercises
Studien- / Prüfungsleistungen:	
1.1: Presentation, 15 minutes Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Students have to be prepared for a world that's changing fast. Students have to know more about disruptive retail and consumer models, about revolution in thinking and creating unexpected solutions.</p> <p>Students will learn how innovations and business models are shaping the future of retailing, shopping and consumer behaviour. Students will analyse disruptive and non-disruptive retail and consumer business models driven by internet of me, augmented reality, digitalisation or basic business. Students will learn how to apply inventive business models that drive retail and consumer business.</p> <p>Students know how to organize and manage a project. Students are prepared to handle specific assignments/projects at work.</p> <p>The students are able to apply techniques and tools they have learned in international real-life projects.</p> <p>Subject competence:</p> <ul style="list-style-type: none"> • understand disruptive retail business models and their impact on consumer behavior. • have insights into digital transformation processes in retail and consumer industries. <p>Methodological competence:</p> <ul style="list-style-type: none"> • will be able to demonstrate proficiency in the application of project management techniques for interdisciplinary and international retail projects. • use business intelligence tools and dashboards for reporting project progress and outcomes. <p>Personal/Self-competence:</p> <ul style="list-style-type: none"> • have an entrepreneurial mindset and resilience in fast-changing environments. • show critical thinking and creativity in developing innovative solutions. <p>Social competence:</p> <ul style="list-style-type: none"> • collaborate in multicultural and interdisciplinary teams. • communicate effectively within project environments and towards external stakeholders. 	

Content:

Students will discuss new technologies, innovations and disruptive business models that are changing the face of retail and enhancing customer experience. Students will learn about new digital business models and non-traditional competitors. Students will explore the key issues of retail and consumer business models. Students will learn to identify ideas, to analyse disruptive and non-disruptive businesses, to create a new strategy.

To be prepared in project management students will have the opportunity to take an extra course in project management:

VHB course:

Prof. Dr. Markus Westner

<https://kurse.vhb.org/VHBPORTAL/kursprogramm/kursprogramm.jsp?kDetail=true>

Literature:

- PINTO, Jeffrey K., 2016. *Project management: achieving competitive advantage*. Harlow: Pearson Education. ISBN 978-1-292-09479-3, 1-292-09479-6
- BERMAN, Barry, Joel R. EVANS and Patrali CHATTERJEE, 2018. *Retail management: a strategic approach*. Harlow, England: Pearson. ISBN 978-1-292-21467-2, 1-292-21467-8
- WANNENWETSCH, Helmut, 2004. *E-Supply-Chain-Management: Grundlagen, Strategien, Praxisanwendungen*. Wiesbaden: Gabler. ISBN 3-409-22015-1
- TAYUR, Sridhar, 2003. *Quantitative models for supply chain management*. Boston [u.a.]: Kluwer Acad. Publ. ISBN 0-7923-8344-3
- WILLIAMS, Luke, 2016. *Disrupt: Think the Unthinkable to Spark Transformation in Your Business*.

Risk of greenwashing: How to communicate sustainability	
Module abbreviation:	NW_RGW
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Matthäus, Carsten
Lecturers:	Matthäus, Carsten
Language of instruction:	English
Credit points / SWS:	3 ECTS / 2 SWS
Workload:	Contact hours: 23 h
	Self-study: 52 h
	Total: 75 h
Subjects of the module:	2.1.10: Risk of greenwashing: How to communicate sustainability
Lecture types:	2.1.10: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>2.1.10: LN - seminar paper</p> <p>Additional Explanation:</p> <p>The examination consists firstly of participation in the first two days of the seminar, during which the topics will be discussed. Secondly, on the third or fourth day of the seminar, students must give a presentation (this can also be done in groups up to four students) and submit a short seminar paper.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>1 Understanding Greenwashing and Its Implications: Equip participants with a clear understanding of what constitutes greenwashing, its ethical, legal, and reputational risks, and how it affects stakeholders in the business environment.</p> <p>11. Effective Sustainability Communication: Teach participants how to craft transparent, authentic, and effective sustainability messages that align with their organization's values and objectives, avoiding misleading claims.</p> <p>12. Building Risk Awareness inside the Company: Enable participants to communicate internally, how business practices have to be adapted in order to avoid future damages to the company's reputation.</p>	
Content:	
<p>1 Fundamentals of Greenwashing, Sustainability and Communication</p> <ul style="list-style-type: none"> - Definition and types of greenwashing - Case studies of failures and successes - Special requirements of sustainability communication <p>13. Communicating Sustainability</p> <ul style="list-style-type: none"> - Planning, creating and substantiating sustainability communication - Assessing the risk of poor or incomplete communication efforts - Understanding research methods of journalists and NGOs <p>14. Assessing Risks, Dealing with Crises</p> <ul style="list-style-type: none"> - Developing a risk-radar for future communication challenges - Responding to greenwashing claims - Communicating in periods of crisis 	

Literature:

- N.N. SCHNEIDER ELECTRIC SE, 2025. *Steering Clear of Greenwashing Claims* [online]. PDF e-Book. Available via: <https://perspectives.se.com/communications-services/steering-clear-of-greenwashing-claims>.
- WEDER, Franzisca, KRÄINER, Larissa, KARMAŠIN, Matthias, 2021. *The sustainability communication reader: a reflective compendium* [online]. Wiesbaden: Springer VS PDF e-Book. ISBN 978-3-658-31883-3. Available via: <https://doi.org/10.1007/978-3-658-31883-3>.
- NEMES, N., 2022. *An Integrated Framework to Assess Greenwashing. Sustainability 2022* [online]. PDF e-Book. Available via: <https://doi.org/10.3390/su14084431>.
- HOFFMANN, André, VANHAM, Peter, 2024. *The New Nature of Business: The Path to Prosperity and Sustainability* [online]. PDF e-Book. ISBN 978-1-394-25753-9.

Strategic Brand Development & Go-to-Market Management - Master	
Module abbreviation:	ECV_SBD&GtMM
Curriculum:	Programmes
	Entrepreneuership and Corporate Venturing (ECV-M) - SPO-Nr.: 3
Responsible for module:	Seckinger, Christoph
Lecturers:	Seckinger, Christoph; Weiss, Patrick
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	3.3: Strategic Brand Development & Go-to-Market Management
Lecture types:	3.3: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
<p>3.3: LN - project work</p> <p>Additional Explanation:</p> <p>Exam: Project work to be performed during the semester, including the development of brand concept for a new venture, creation of a two-page brand guideline, preparation of a Figma template, and the planning and execution of one to three short marketing activities. Written documentation (approx. 10-15 pages) and presentation (15 minutes).</p> <p>Additional remarks: A voluntary bonus system is offered: Within the course, selected topics may be taken up by students for individual preparation and presentation. Each qualitatively completed presentation earns bonus points amounting to a maximum of 10% of the total achievable exam points. The creditability and maximum allocation of bonus points follow the regulations of the APO.</p>	
Recommended prerequisites:	
Completed Business Model Canvas and a defined startup idea.	
Objectives:	
<p>Subject competence</p> <ul style="list-style-type: none"> • Students understand strategic principles of brand development and their application in startup, corporate venture building, and early-stage investment contexts. • They are familiar with key models of brand identity (e.g., Kapferer's Brand Identity Prism) and can apply them to develop coherent brand systems. • They are able to analyze markets, define a positioning, and translate strategic insights into actionable brand and marketing concepts, using generative AI-Tools for market research (synthetic personas) or efficient asset creation. • Students can connect brand-building decisions to measurable business outcomes. <p>Methodological competence</p> <ul style="list-style-type: none"> • Students can conduct structured market and customer analyses to derive relevant brand insights. • They are able to plan, develop, and test brand concepts through iterative project work; or evaluate existing brand concepts in e.g. investment scenarios. • They can design and evaluate marketing activities using frameworks such as the Bullseye approach. <p>Personal / Self-competence</p> <ul style="list-style-type: none"> • Students strengthen their creative and analytical problem-solving skills through iterative brand development. 	

- They develop the ability to manage complex strategic and creative processes independently.
- They reflect on their personal role as brand creators and decision-makers in dynamic market environments.

Social competence

- Students collaborate effectively in interdisciplinary teams combining business and technical expertise.
- They provide constructive feedback and integrate diverse perspectives during team and peer-review sessions.

Content:

The module follows a structured brand-building process consisting of five interconnected stages (5D Method):

- 1 Discover:** Re-asses prior work, analyzing the existing startup idea’s market and customer insight using secondary and primary research data; identification of core customer jobs and pain points for further usage in the brand development. Students without an existing business model idea will use this timeframe for initial set-up.
15. **Define:** Segmentation, targeting, and positioning in the context of new ventures; developing a clear brand route and audience understanding.
16. **Develop:** Creation of the brand identity (e.g., using Kapferer’s Brand Identity Prism) and definition of major building blocks such as naming, brand character, and tone of voice.
17. **Design:** Translation of identity into visual assets; production of brand guidelines and Figma design templates.
18. **Deploy:** Planning and execution of a Go-to-Market strategy using the Weinberg & Mares’ Bullseye framework; testing and evaluation of early marketing traction ideas.
19. **Presentation:** Final brand presentation and reflection on learnings.

Literature:

- WHEELER, Alina and Rob MEYERSON, 2024. *Designing Brand Identity: A Comprehensive Guide to the World of Brands and Branding*. Newark: John Wiley & Sons, Incorporated. ISBN 978-1-119-98482-5
- KAPFERER, Jean-Noël, 2012. *The new strategic brand management: advanced insights and strategic thinking*. London; Philadelphia, Pa.; New Delhi: Kogan Page. ISBN 978-0-749-46516-2
- WEINBERG, Gabriel and Justin MARES, 2015. *Traction: how any startup can achieve explosive customer growth*. New York, New York: Portfolio/Penguin. ISBN 978-1-59184-836-3, 1-59184-836-9
- Rachitsky, L. (Ongoing). Lenny's Newsletter / Podcast. A leading resource on startup growth, product management, and go-to-market strategies.

Strategic Management	
Module abbreviation:	BW_StratM and BW_StratM-CS
Curriculum:	Programmes
	Betriebswirtschaft (BW-B) - SPO-Nr.: 2
Responsible for module:	Jünger, Michael
Lecturers:	Warrings, Vincent; Jünger, Michael
Language of instruction:	English
Credit points / SWS:	8 ECTS / 6 SWS
Workload:	Contact hours: 70 h
	Self-study: 130 h
	Total: 200 h
Subjects of the module:	2.1.1: Strategic Management (BW_StratM)
	2.1.2: Strategic Management / Case Studies (BW_StratM-CS)
Lecture types:	2.1.1.: SU - lecture
	2.1.2.: Pr - exercise
Studien- / Prüfungsleistungen:	
<p>2.1.1-Strategic Management: schrP90 - written exam, 90 minutes (BW_StratM)</p> <p>2.1.2-Strategic Management / Case Studies: LN - presentation (15-30 min.) and written composition (10-15 pages) (BW_StratM-CS)</p> <p>Additional Explanation: Both subjects of the module must be attended and passed in order to receive ECTS!!!</p> <p>This course cannot be chosen in combination with the course "International Strategic Management" (International Management degree program).</p>	
Recommended prerequisites:	
None	
Objectives:	
<p><i>Strategic Management</i></p> <p>Professional competence</p> <p>The students are able to...</p> <ul style="list-style-type: none"> • explain the purpose, scope and relevance of strategic management in organizations. • describe and differentiate corporate-level, business-level and functional-level strategies. • analyze industry structures, competitive positions and strategic challenges using established strategic management frameworks. • evaluate strategic options with regard to competitive advantage, value creation and long-term performance. <p>Methodological competence</p> <p>The students are able to...</p> <ul style="list-style-type: none"> • apply instruments of strategic analysis and strategy design to practical business cases and entrepreneurial ideas. • structure and develop coherent strategic concepts by integrating external analysis, internal resources and strategic objectives. • assess strategic decisions and their implications under conditions of uncertainty and limited information. <p>Personal / self-competence</p> <p>The students are able to...</p>	

- reflect on their own strategic reasoning and decision-making processes.
- work independently on complex strategic tasks and manage their learning process responsibly.

Social competence

The students are able to...

- work effectively in teams when developing and discussing strategic concepts.
- communicate strategic analyses and recommendations clearly and convincingly in written and oral form.

The students

- are able to understand the leadership challenges in today's world
- understand the dimensions of Entrepreneurial Spirit
- are able to put strategic questions and to apply instruments of strategic leadership and innovation
- are ready to create the dimensions of a competitive Business Design

Strategic Management/ Case Studies

The students

- can apply the instruments of strategic and operational management with a clear focus on customer advantage and competitive advantage
- know how to develop certain topics of strategic management within a business framework
- can apply business cases within certain topics of strategic management
- have the competence to apply management tools

Content:

Strategic Management

This module provides an application-oriented introduction to strategic management by combining conceptual foundations, analytical tools and practical examples.

Key topics include:

- Introduction to strategic management and executive decision-making.
- Strategy and management in dynamic and competitive markets.
- Levels of strategy: corporate, business and functional strategies.
- External analysis: industry structures, competitive forces and market developments.
- Internal analysis: resources, capabilities and core competencies.
- Competitive advantage and business model design.
- Strategy design innovation approaches and analytical toolsets.
- Strategy formulation in different industry and market contexts.
- Strategy implementation, execution and performance management.
- Case studies and applied group work based on business or entrepreneurial ideas.

Strategic Management/ Case Studies

- Business Planning
- Business Models
- Business Development
- Strategy Implementation

Literature:

Strategic Management

- JÜNGER, Michael and others, 2024. *Strategy design innovation: how to create business success using a systematic toolbox*. Completely revised 6. edition. Augsburg: ZIEL. ISBN 978-3-96557-135-8, 3-96557-135-4
- GRANT, Robert M., 2025. *Contemporary strategy analysis*. Hoboken, NJ: Wiley. ISBN 978-1-394-25159-9
- HILL, Charles W. L., Melissa A. SCHILLING and Gareth R. JONES, 2024. *Strategic management: an integrated approach: theory & cases*. 14. edition. Boston, MA: Cengage. ISBN 978-0-357-71662-5

- LYNCH, Richard and others, 2024. *Strategic Management*. 12. edition. London: SAGE. ISBN 978-1529672565

Strategic Management/ Case Studies

- WITTMANN, Robert G. and others, 2019. *Strategy design innovation: how to create business success using a systematic toolbox*. Completely revised 5. edition. Augsburg: ZIEL. ISBN 978-3-96557-077-1, 3-96557-077-3
- GRANT, Robert M., 2010. *Contemporary strategy analysis*. Hoboken, NJ: John Wiley & Sons. ISBN 0-470-74710-2, 978-0-470-74710-0
- HABERBERG, Adrian and Alison RIEPLE, 2008. *Strategic management: theory and application*. Oxford [u.a.]: Oxford Univ. Press. ISBN 978-0-19-921646-8
- HUNGENBERG, Harald, 2008. *Strategisches Management in Unternehmen: Ziele, Prozesse, Verfahren*. Wiesbaden: Gabler. ISBN 978-3-8349-1260-2
- MACHARZINA, Klaus and Joachim WOLF, 2008. *Unternehmensführung: das internationale Managementwissen; Konzepte, Methoden, Praxis*. Wiesbaden: Gabler. ISBN 978-3-8349-1119-3
- WELGE, Martin K. and Andreas AL-LAHAM, 2008. *Strategisches Management: Grundlagen, Prozess, Implementierung*. Wiesbaden: Gabler. ISBN 978-3-8349-0313-6, 3-8349-0313-2
- WHEELLEN, Thomas L. and J. David HUNGER, 2008. *Strategic management and business policy: concepts and cases*. 11. edition. Upper Saddle River, NJ: Prentice Hall. ISBN 978-0-13-606827-3, 0-13-606827-8
- WITTMANN, Robert G. and Matthias REUTER, 2008. *Strategic planning: how to deliver maximum value through effective business strategy*. London [u.a.]: Kogan Page. ISBN 978-0-7494-5233-9

Successful Management in a Global World	
Module abbreviation:	FW_SMGW
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2 Global Economics and Business Management (GBM-B) - SPO-Nr.: 2
Responsible for module:	Hahn, Christoph
Lecturers:	Hahn, Christoph
Language of instruction:	English
Credit points / SWS:	3 ECTS / 2 SWS
Workload:	Contact hours: 23 h
	Self-study: 52 h
	Total: 75 h
Subjects of the module:	2.1.9: Successful Management in a Global World
Lecture types:	2.1.9: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
2.1.9: LN - seminar paper Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
<p>Firstly, students will be enabled to recognize culture specific features and peculiarities which are important to establish open-minded relations in business. This is a prerequisite for successfully executing business with customers abroad.</p> <p>Secondly, students will learn about the different management methods and styles which enable them to work abroad either in a foreign company or in a subdivision of their parent company.</p> <p>At the end of the lecture, student will also</p> <ul style="list-style-type: none"> • have cultural specific knowledge (East-West: USA-Europe-Asia) in relation to international management. • be aware of communication, management and leadership methods in different cultures. • know about culture related techniques and behaviors. 	
Content:	
<ul style="list-style-type: none"> • Economical facts, historical developments as well as current living conditions of special countries (e.g. East-West: in particular USA, Europe, Asia (Japan, Taiwan, China, Korea, and Singapore). According to particular participant`s interest special countries can be focused on • Introduction of cultural dimensions and their influence on management functions in business relations is one of the most important discussion points • Main management functions: Organization, Planning, Human Resources, Leadership, and Controlling. These functions will be discussed in the context of cultural dimensions 	
Literature:	
<ul style="list-style-type: none"> • ENGELN, Andreas and Eva THOLEN, 2014. <i>Interkulturelles Management</i>. Stuttgart: Schäffer-Poeschel. ISBN 978-3-7910-3248-1; 3-7910-3248-8 • TROMPENAARS, Fons. <i>Website</i> [online]. Available via: https://www.crossknowledge.com/de/faculty/fons-trompenaars-biografie-de • HOFSTEDE, Geert. <i>Website</i> [online]. [Available via: https://geerthofstede.com/] 	

Successful Negotiations in a Global World	
Module abbreviation:	SW_SNGW
Curriculum:	Programmes
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2
Responsible for module:	Hahn, Christoph
Lecturers:	Hahn, Christoph
Language of instruction:	English
Credit points / SWS:	3 ECTS / 2 SWS
Workload:	Contact hours: 24 h
	Self-study: 51 h
	Total: 75 h
Subjects of the module:	2.1.8: Successful Negotiations in a Global World
Lecture types:	2.1.8: SU/Ü - lecture with integrated exercises
Studien- / Prüfungsleistungen:	
2.1.8: LN - seminar paper Additional Explanation: None	
Recommended prerequisites:	
None	
Objectives:	
The students are able: <ul style="list-style-type: none"> to apply culture specific knowledge (East-West: USA-Europe-Asia) in negotiations. to be aware management- and leadership styles. to apply different negotiation strategies and techniques will be explained and trained in role-plays. 	
Content:	
<p>Economical facts, historical developments as well as current living conditions (East-West: in particular USA, Europe, Asia (Japan, Taiwan, China, Korea, Singapore)).</p> <p>The cultural dimensions and their influence on negotiations in business relations will be introduced and discussed. Negotiation strategies and techniques will be a major topic and trained in role plays.</p> <p>The participants should be enabled to perceive culture specific features and peculiarities which is important to establish open-minded relations which again is a prerequisite for successfully negotiate with international business partners.</p>	
Literature:	
<ul style="list-style-type: none"> HECHT-EL MINSHAWI, Béatrice, 2008. <i>Interkulturelle Kompetenz: Soft Skills für die internationale Zusammenarbeit; [wichtige Infos in Englisch]</i>. Weinheim [u.a.]: Beltz. ISBN 978-3-407-36469-2 TROMPENAARS, Fons. <i>Website</i> [online]. Available via: https://www.crossknowledge.com/de/faculty/fons-trompenaars-biografie-de HOFSTEDE, Geert. <i>Website</i> [online]. Available via: https://geerthofstede.com/ MAHBUBANI, Kishore, 2009. <i>Can Asians think?</i> Singapore: Marshall Cavendish. ISBN 978-981-4276-01-6 	

Supply Chain Management in Retailing - Master	
Module abbreviation:	RCM_SCMR
Curriculum:	Programmes
	Retail und Consumer Management (RCM-M) - SPO-Nr.: 4
Responsible for module:	Sternbeck, Michael
Lecturers:	Sternbeck, Michael
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	4.3: Supply Chain Management in Retailing
Lecture types:	SC / E: seminar course with exercises
Studien- / Prüfungsleistungen:	
<p>4.3: schrP90 - written exam, 90 minutes</p> <p>Additional Explanation:</p> <p>There will be a final exam of 90 minutes. You are allowed to use a non-programmable pocket calculator during the exam.</p>	
Recommended prerequisites:	
None	
Objectives:	
<p>Goal of the course is to understand supply chain planning and logistics execution in the retail and consumer goods industries. Motivated by practical challenges, we look at different logistics tasks on the strategic, tactical and operational planning level.</p> <p>Subject competence:</p> <ul style="list-style-type: none"> • will be familiar with retail-specific supply chain structures and sustainability principles. • understand omnichannel logistics and distribution concepts. <p>Methodological competence:</p> <ul style="list-style-type: none"> • Optimization of supply chains through digital tools and data analysis. • Assessment of logistics networks on strategic, tactical, and operational levels. <p>Personal/Self-competence:</p> <ul style="list-style-type: none"> • Analytical thinking and structured problem-solving skills. • Attention to detail in logistics planning. <p>Social competence:</p> <ul style="list-style-type: none"> • Collaboration across supply chain partners. • Teamwork within cross-functional supply chain environments. 	
Content:	
<p>Main content of the course is:</p> <ul style="list-style-type: none"> • Relevance of supply chain management in the retail context • Strategic supply network configuration • Distribution concepts and delivery mode planning • Warehouse management 	

- Transportation management
- Instore operations management
- Omnichannel operations

Literature:

- BOZARTH, Cecil B. and Robert B. HANDFIELD, 2016. *Introduction to Operations and Supply Chain Management*. Harlow: Pearson. ISBN 9781292093420
- CHRISTOPHER, Martin, 2016. *Logistics and Supply Chain Management*. Harlow: Pearson Education. ISBN 9781292083797
- HÜBNER, Alexander, KUHN, Heinrich, STERNBECK, Michael, 2013. Demand and Supply Chain Planning in Grocery Retail: An Operations Planning Framework. In: *International Journal of Retail & Distribution Management*. (41(7))
- CHOPRA, Sunil and Peter MEINDL, 2013. *Supply Chain Management*. Harlow: Pearson. ISBN 9780273765226
- FERNIE, John and Leigh SPARKS, 2019. *Logistics and Retail Management*. London: Kogan Page. ISBN 9780749481605

Sustainability, CSR and Compliance Management	
Module abbreviation:	GBM_SCSR&CM
Curriculum:	Programmes
	Global Economics and Business Management (GBM-B) - SPO-Nr.: 2
Responsible for module:	Loza Adauí, Cristian Rolando
Lecturers:	Loza Adauí, Cristian Rolando
Language of instruction:	English
Credit points / SWS:	6 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 103 h
	Total: 150 h
Subjects of the module:	2.3: Sustainability, CSR and Compliance Management
Lecture types:	SU/Ü - lecture with integrated exercises The course can take place either partially or entirely in a virtual format. Further information can be found in the timetable and/or will be provided by the lecturer.
Studien- / Prüfungsleistungen:	
2.3: schrP90 - written exam, 90 minutes Additional Explanation: None	
Recommended prerequisites:	
Knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.	
Objectives:	
At the end of the course the students:	
Knowledge	
<ul style="list-style-type: none"> Understand the concepts of compliance, sustainability, and corporate social responsibility (CSR) and explain their theoretical foundations within a global business context. Identify the connection between CSR and sustainable development, both in general and specifically within business administration. Distinguish between the shareholder and stakeholder approaches and critically evaluate their implications for the purpose of business and its role in society. 	
Methodology	
<ul style="list-style-type: none"> Apply the fundamental principles of sustainability controlling and reporting, with a particular focus on key performance indicators (KPIs) used in measuring sustainability efforts. Analyze practical case studies to bridge theoretical knowledge with real-world CSR activities, developing a critical perspective on corporate social responsibility practices. Utilize compliance frameworks to understand how laws and company regulations shape ethical business practices on a global scale. 	
Personality	
<ul style="list-style-type: none"> Develop a personal understanding of the ethical implications of compliance and sustainability practices and apply them in both professional and personal decision-making. Reflect on individual responsibility in maintaining compliance and promoting ethical behavior within the business environment. 	
Social Competence	

- Collaborate in discussions and team projects to evaluate CSR initiatives and compliance challenges from diverse perspectives, contributing to a broader understanding of business's role in society.
- Communicate effectively about sustainability, CSR, and compliance in professional contexts, addressing the diverse needs and interests of various stakeholders.

Content:

- Historical perspectives on sustainability, CSR and Compliance Management
- CSR and the theory of business administration: Contradiction in terms?
- Is business part of society or “is the business of business business”?
- Definition of CSR and relation to the concept of sustainability/sustainable development
- Shareholder vs. Stakeholder approach
- The four theoretical perspectives on CSR
- Strategic Corporate Sustainability and Responsibility
- Is there a “business case” for CSR?
- Sustainable Circular Business Models
- CSR and sustainability standards
- CSR and sustainability reporting
- How to implement CSR: Examples/case studies from different industries
- Ethics and compliance
- Definition of compliance with an international scope
- Perception of compliance in different countries and companies
- Structure and concepts for corporate compliance
- Behaviour in compliance situation
- Compliance challenges when making business in a global environment
- Compliance cases in various industries and politics

Literature:

- RASCHE, Andreas and others, 2023. *Corporate Sustainability: Managing Responsible Business in a Globalised World*. ISBN 9781009114929
- HAHN, Rüdiger, 2022. *Sustainability Management: Global Perspectives on Concepts, Instruments, and Stakeholders*. ISBN 978-3-9823211-1-0
- FRÖHLICH, Elisabeth and others, 2025. *Circular Economy in Sustainable Supply Chains: A Global Perspective on Challenges, Concepts and Cases*. Cham: Springer. ISBN 978-3-031-70748-3
- HAYWARD, Andrew and Tony OSBORN, 2019. *The Business Guide to Effective Compliance and Ethics*. ISBN 9780749482978
- PUFÉ, Iris, 2017. *Nachhaltigkeit*. Konstanz: UVK Verlagsgesellschaft mbH. ISBN 978-3-8252-8705-4, 3-8252-8705-X
- WEBER, Jürgen and others, 2012. *Nachhaltigkeit und Controlling*. Weinheim: Wiley-VCH. ISBN 978-3-527-50652-1
- HANDY, Charles, 2003. What's a Business For? Harvard Business Review on Corporate Responsibility. In: *Harvard Business Review (HBR)*, p.65-82.
- Without author. *Overcoming compliance fatigue. Reinforcing the commitment to ethical growth. 13th Global Fraud Survey* [online], 2014. Available via: <https://vdocuments.net/reader/full/overcoming-compliance-fatigue-reinforcing-the-commitment-to-ethical-growth-13th-global-fraud-survey-2014>
- Without author. *Report from the Commission to the Council and the European Parliament. EU Anti-corruption report* [online]. Available via: https://eur-lex.europa.eu/resource.html?uri=cellar:058aecf0-d9b7-11e3-8cd4-01aa75ed71a1.0012.01/DOC_1&format=PDF
- FOX, Thomas R. *The Five Essential Elements of a Corporate Compliance Program - Part I* [online], 2012 Available via: <https://tfoxlaw.wordpress.com/2012/09/07/the-five-essential-elements-of-a-corporate-compliance-program-part-i/>
- FOX, Thomas R. *The Five Essential Elements of a Corporate Compliance Program - Part II* [online], 2012. Available via: <https://tfoxlaw.wordpress.com/2012/09/09/the-five-essential-elements-of-a-corporate-compliance-program-part-ii/>
- CHERRY, Kendra. *The Psychology of Compliance* [online], 2021. Available via: <https://www.verywellmind.com/what-is-compliance-2795888>

- FREEMAN, R. Edward and others, 2010. *Stakeholder theory: the state of the art*. Cambridge [u.a.]: Cambridge Univ. Press. ISBN 978-0-521-19081-7, 0-521-19081-9
- SINGH, Nitish and Thomas J. BUSSEN, 2015. *Compliance Management: A How-to Guide for Executives, Lawyers, and Other Compliance Professionals*. Santa Barbara, California: Praeger. ISBN 9781440833113



Course Descriptions

Language Centre

International Office

Summer term 2026

As per: 2026-02-03

This program and course description becomes effective on 15.03.2026. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations.

Overview

Sprachenangebot des Sprachenzentrums

Subject	SWS	ECTS
German A1.1	4	5

Module Descriptions German A1.1	
Module abbreviation:	SZ_GERM_A1_1
Curriculum:	Programmes
	Sprachenangebot des Sprachenzentrums (SZ-Sprachen)
Responsible for module:	Reicherstorfer, Anja
Lecturers:	Kraus, Dorothea
Language of instruction:	German
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	-: German A1.1
Lecture types:	SU/Ü – seminaristischer Unterricht/Übung
Studien- / Prüfungsleistungen:	
LN - written exam, 90 minutes	
Recommended prerequisites:	
None	
Objectives:	
Students are able to build simple sentences about themselves, their families and their immediate surroundings, understand simple questions and conversations and talk about everyday topics.	
Content:	
<p>Introductions, ask questions and talk about home countries and professions, name and describe things, talk about and understand prices of things. Talk about food and drinks, visiting a restaurant and the cafeteria - understand the menu. Talk about leisure time activities, make appointments and talk about daily routines. Ask questions and talk about the past. Grammar: Present and past tense. Negation using "nicht/kein/keine". Definite and indefinite possessive pronoun. Singular and plural forms. Temporal prepositions, modal verbs, nominative and accusative case. Verbs with separable prefixes.</p>	
Literature:	
<ul style="list-style-type: none"> • EVANS, Sandra, Sabine GLAS-PETERS and Sabine SCHLÜTER, . <i>Menschen A1.1: Deutsch als Fremdsprache</i>. Ismaning: Hueber Verlag. ISBN 978-3-19-301901-1 • GLAS-PETERS, Sabine, Angela PUDE and Monika REIMANN, . <i>Arbeitsbuch: Menschen A 1.1, Deutsch als Fremdsprache</i>. Ismaning: Hueber. ISBN 978-3-19-311901-8 	