Module Handbook for Exchange Students

Winter Semester 24/25

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. You cannot take consecutive language courses. This means that you must complete a level first, before you can register for the next level. (e.g., German must be completed before selecting German A2.1). Exceptions are Technical German 1 and Technical German 2 (those can be taken alongside German B2 or with each other - a total of two per semester).

3. The German half level course is recommended for exchange students (German A1.1). **Intensive courses are not open to exchange students.**

4. The admission requirement is a mandatory part of the course (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.**

5. **Courses which are not listed in the guest 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** (does not apply for KOSPIE. KOSPIE students can select German taught courses if they have a German B2 level from the CEFR)

6. Concerning the course "**International Business Simulation**": Please note: the computer simulation game must be accepted by October 10th, 2024.

7. Concerning the Business school courses "Strategic Management" and "Strategic Management – Case Studies": **Please note that both subjects of the module must be attended and passed to receive ECTS!!!**

7. **This module handbook is subject to change.** The latest version of the module handbook will be published on the THI website end of September 2024.

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

Content:

Course Descriptions

Mechanical Engineering

This program and course description becomes effective on 01.10.2024. 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

Fach	SWS	ECTS
Basics of Mechanical Design	4	5
Computer Science in Engineering	4	5
Computer Science in Engineering (admission requirement)	0	0
Electrical Engineering	4	5
Energy from Biomass and Biogenic Residues	5	5
Energy Management and Energy Efficiency (Master)	4	5
Engineering Mathematics 1	5	5
Fluid Mechanics	5	5
Fluid Mechanics (admission requirement)	0	0
Machine Elements	4	5
Measurement Engineering	4	5
Mobility within the Energy System	4	5
Statics	4	5
System Analysis and Control (Master)	5	5
Thermodynamics 2	4	5

Master RES

Fach	SWS	ECTS
Energy Management and Energy Efficiency	4	5
System Analysis and Control	4	5

1 Module Descriptions

Basics of Mechanical Design

Module abbreviation:	BMDesign_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 6

Responsible for module:	Moll, Klaus-Uwe
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:	6: Basics of Mechanical Design (BMDesign_ESYS)
Lecture types:	6-Basics of Mechanical Design: SU/Ü - lecture with integrated exercises (BMDesign_ESYS)

Studien- / Prüfungsleistungen:

6-Basics of Mechanical Design: schrP120 - written exam, 120 minutes (BMDesign_ESYS)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

6 Basics of Mechanical Design:

The students

- know which standards have to be taken into account for the creation of technical drawings
- can use these standards to create complete and standardized graphic representations of constructions
- can use the various projection methods
- know what tolerances exist and can apply this knowledge correctly
- can apply their knowledge of the representation of the representation of various machine elements in technical drawings
- can develop new components and assemblies by linking their knowledge and design them for production

Content:

6 Basics of Mechanical Design:

- Contents of technical drawings:
- Symbolic representations used
- Projection methods for the graphic representation of technical products
- Sectional representations, cutouts, views, details
- Dimensioning, dimensioning rules, edge symbols
- ISO tolerance system, surface information, shape and position tolerances, tolerance calculation
- Typical machine elements and standard parts and their graphic representation
- Design guidelines for various manufacturing processes
- Creation of freehand sketches
- Geometrical product specification

Literature:
Compulsory: • GOMERINGER, Roland and others, 2018. *Mechanical and Metal Trades Handbook*. 4. edition. Haan-Gruiten: Verlag Europa-Lehrmittel, Nourney, Vollmer GmbH & Co. KG. ISBN 978-3-8085-1915-8, 3-8085-1915-0   • ISO, 2020. *ISO 128-1:2020: Technical product documentation (TPD) — General principles of representation — Part 1: Introduction and fundamental requirements*. . Berlin: Beuth   • ISO, 2022. *ISO 128-2:2022: Technical product documentation (TPD) - General principles of representation - Part 2: Basic conventions for lines*. . Berlin: Beuth   • ISO, 2022. *ISO 128-3:2022: Technical product documentation (TPD) - General principles of representation - Part 3: Views, sections and cuts*. . Berlin: Beuth   • ISO, 2020. *ISO 128-100:2020: Technical product documentation - General principles of representation - Part 100: Index*. . Berlin: Beuth   • DIN EN ISO, 2013. *ISO 286-1:2010 + Cor 1:2013: Geometrical product specifications (GPS) - ISO code system for tolerances on linear sizes - Part 1: Basis of tolerances, deviations and fits*. . Berlin: Beuth   • DIN EN ISO, 2013. *ISO 286-2:2010 + Cor 1:2013: Geometrical product specifications (GPS) - ISO code system for tolerances on linear sizes - Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*. . Berlin: Beuth   *Recommended:*   None

Computer Science in Engineering

Module abbreviation:	CScEng_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 3

Responsible for module:	Lange, Marlene

Lecturers:	Lange, Marlene (CScEng_ESYS) Lange, Marlene (CScEngAR_ESYS)

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: Computer Science in Engineering (CScEng_ESYS) 3.1: Computer Science in Engineering (admission requirement) (CScEngAR_ESYS)

Lecture types:	3-Computer Science in Engineering: SU/Ü/PR - seminar based teaching/Exercise course/laboratory (CScEng_ESYS) 3.1-Computer Science in Engineering (admission requirement): SU/Ü/PR - seminar based teaching/Exercise course/laboratory (CScEngAR_ESYS)

Studien- / Prüfungsleistungen:

3-Computer Science in Engineering: schrP90 - written exam, 90 minutes (CScEng_ESYS)

3.1-Computer Science in Engineering (admission requirement): (Practical work), 2-7 experiments with 2-5 pages of documentation each (CScEngAR_ESYS)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

3 Computer Science in Engineering:

After attending the course, students

- Understand the basic principles of data representation and processing with computers.
- Have the ability to develop a solution to a given problem and to represent it as an algorithm so that it can be implemented into a programming language.
- Have basic programming knowledge that enables the creation and execution of simple programs and the ability to define and implement the interfaces of a system.
- Understand syntax and semantics of a programming language.
- Achieve basic skills about the implementation of arbitrary real-world entities into a programming language.
- Are able to create a structured model from a set of requirements that can be implemented in a programming language.
- Have a practical understanding about hard and software in the field of computer science.
- Can discuss within the field of computer science and engineering.

3 Computer Science in Engineering (admission requirement) (CScEngAR_ESYS):

The goal of the admission requirement is that the students learn to practically apply the theory of the computer science course. They learn:

- to develop and implement simple algorithms
- to write, execute and debug a computer programm
- the basic syntax and semantics of a programming language

Content:

3 Computer Science in Engineering:

- History of computers and programming languages
- Data representation within computers
- Introduction to algorithms
- Basic syntax and semantics of a programming language
- Variables and data types
- Control structures (loops, conditionals)
- Functions for code organization
- Working with basic data structures
- Writing and debugging code
- The principles of object-oriented programming (OOP)
- Creating and using classes and objects

3 Computer Science in Engineering (admission requirement) (CScEngAR_ESYS):

The students have to solve a given number of tasks from the area of computer science. Depending on the level of task completion they are admitted to the final exam, or not.

Literature:

Compulsory:

None

Recommended:

- CORMEN, Thomas H. and others, 2009. *Introduction to algorithms*. T. edition. Cambridge, Massachusetts ; London, England: The MIT Press. ISBN 978-0-262-27083-0
- INDEN, Michael, 2022. *Python Challenges: 100 Proven Programming Tasks Designed to Prepare You for Anything* [online]. Berkeley, CA: Apress PDF e-Book. ISBN 978-1-4842-7398-2. Available via: https://doi.org/10.1007/978-1-4842-7398-2.
- PETZOLD, Cahrles, 2000. *CODE: the hidden language of computer hardware and software*. Redmond, Wash.: Microsoft Press. ISBN 0-7356-0505-X, 0-7356-1131-9
- MATTHES, Eric, 2023. *Python crash course: a hands-on, project-based introduction to programming*. 3. edition. San Francisco: No Starch Press. ISBN 978-1-7185-0270-3

Compulsory:

None

Recommended:

- See recommended literature for the Computer Science in Engineering course.

Electrical Engineering

Module abbreviation:	ETE_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 10

Responsible for module:	Navarro Gevers, Daniel
Lecturers:	Navarro Gevers, Daniel; Ndong, Massa
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:	10: Electrical Engineering (ETE_ESYS)
Lecture types:	10-Electrical Engineering: SU/Ü - lecture with integrated exercises (ETE_ESYS)

Studien- / Prüfungsleistungen:

10-Electrical Engineering: schrP90 - written exam, 90 minutes (ETE_ESYS)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

10 Electrical Engineering:
The students
- know and use specialist terminology confidently
- know the basic physical laws of electrical engineering and their connection
- know the boundary conditions of particular laws of physics
- are able to select the appropriate laws defining a given problem
- are proficient in calculations with appropriate units
- are proficient in methods calculating direct current and alternate current networks
- know the electrical field quantities and are able to calculate them
- know the magnetic field quantities and are able to calculate simple magnetic circuits
- know simple circuits with a transistor
- know basic circuits with an operational amplifier and are able to calculate those
- know measuring instruments for electric quantities and know their possible uses
- are able to familiarise themselves with subjects regarding electrical engineering self-reliant and within a team and are able to discuss these matters competently

Content:

10 Electrical Engineering:
- 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

- Alternate current circuit: sinusoidal change of electric quantities, circuit analysis of alternate current networks using complex numbers, power
- Semiconductors: diode, transistor, operational amplifier, basics of electric circuits; digital circuits
- Measuring electric quantities

Literature:

Compulsory:

- HACKER, Viktor and Christof SUMEREDER, 2020. *Electrical engineering : fundamentals*. München; Wien: De Gruyter Oldenbourg. ISBN 9783110521023
- KORIES, Ralf and Heinz SCHMIDT-WALTER, 2003. *Electrical Engineering : A Pocket Reference*. Berlin, Heidelberg: Springer. ISBN 978-3-540-43965-3

Recommended:

- Further literature will be announced in the lecture.

Energy from Biomass and Biogenic Residues

Module abbreviation:	EBBR_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 30

Responsible for module:	Goldbrunner, Markus
Lecturers:	Goldbrunner, Markus
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:	30: Energy from Biomass and Biogenic Residues (EBBR_ESYS)
Lecture types:	30-Energy from Biomass and Biogenic Residues: SU/Ü/PR - seminar based teaching/Exercise course/laboratory (EBBR_ESYS)

Studien- / Prüfungsleistungen:

30-Energy from Biomass and Biogenic Residues: schrP90 - written exam, 90 minutes (EBBR_ESYS)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

30 Energy from Biomass and Biogenic Residues:
The students
- are able to classify and evaluate the importance of bioenergy in today's and future energy supply
- know the most important renewable raw materials, their properties and sources of supply
- know the most important process engineering principles of the use of biomass (combustion, gasification, fermentation, fuel production) and can apply them
- know the technical concepts and the most important details of the various bioenergy plants for heat, electricity and fuel production and can use them in plant planning and evaluation
- can conceptualise a bioenergy plant, evaluate it economically and present the concept

Content:

30 Energy from Biomass and Biogenic Residues:
Introduction
- Greenhouse effect and renewable energies (focus on biomass, cycle)
- Properties and cultivation of renewable raw materials, problems
- Pathways of biomass use
- Organic residues, food waste and biowaste as feedstocks for energy use
- Basic economic considerations
- Aspects of licensing law
Heat generation
- Combustion concepts for large-scale plants
- Combustion concepts for small-scale plants
- Heat grids

Power generation through combustion

- Fundamentals of combustion
- Emissions
- Special features and design of the firing system
- Plant technology
- Use of waste wood and other residues

Power generation through thermal gasification

- Fundamentals of gasification, reaction kinetics
- Gasifier concepts
- Plant technology
- Utilisation of the gas
- Emissions

Power generation through fermentation (biogas)

- Substrate preparation / utilisation
- Basics of fermentation
- Plant technology
- Biogas pre-treatment, drying, cleaning (desulphurisation), special features of organic residues
- Gas treatment to natural gas quality (CO2 separation, different processes)

Fuels from renewable raw materials

- Basics of fuel production, synthesis
- Biomethane as fuel, filling stations for agriculture (biogas filling stations)
- 1st generation fuels
- 2nd generation fuels

Seminar: Planning a bioenergy production plant

- Plant planning according to HOAI
- Economic efficiency calculation according to VDI 2067
- Conceptual design and presentation of the concept
- Approval

Literature:

Compulsory:

- WELLINGER, Arthur, 2013. *The biogas handbook: science,production and application*. Oxford [u.a.]: Woodhead Publ.. ISBN 978-0-85709-498-8
- SPLIETHOFF, Hartmut, 2010. *Power generation from solid fuels*. Berlin [u.a.]: Springer. ISBN 978-3-642-02855-7

Recommended:

- Further literature will be announced in the lecture.

Energy Management and Energy Efficiency - Master

Module abbreviation:	WMod_EnManaEnEff_M-RES

Curriculum:	**Programmes**
	Master RES (M-Res) - SPO-Nr.: 8

Responsible for module:	Weitz, Peter
Lecturers:	Patel, Dharmik; Weitz, Peter
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:	8: Energy Management and Energy Efficiency (WMod_EnManaEnEff_M-RES)
Lecture types:	8-Energy Management and Energy Efficiency: SU/Ü - lecture with integrated exercises (WMod_EnManaEnEff_M-RES)

Studien- / Prüfungsleistungen:

8-Energy Management and Energy Efficiency: LN - written exam, 90 minutes (WMod_EnManaEnEff_M-RES)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

8 Energy Management and Energy Efficiency:
The students
- understand the design rules of a photovoltaic system and will be able to layout specific systems.
- are familiar with supply versus demand simulations of photovoltaic system in industrial environments and understand methods to increase self consumption of produced energy.
- understand the different contributions of the electricity bill and know methods to reduce costs.
- can analyze and understand electric load profiles and extract exposed loads.
- understand energy management systems and know how to manage exposed loads.
- are familiar with the cross-sectional technologies in industrial companies, can identify potential of savings and take measures to reduce energy consumption

Content:

8 Energy Management and Energy Efficiency:
- Photovoltaic: design rules for solid photovoltaic system layout (connection module to inverter). Overall planning of photovoltaic systems. Simulation of provided energy.
- Electric load profile: analyzing electric load profiles and identification of exposed loads.
- Supply versus demand simulation of photovoltaic systems in industrial environments. Methods of supply and demand displacements.
- Contributions to energy costs of industrial companies and methods to reduce the cost level.
- Energy management systems in industrial companies (DIN EN ISO 50001 and DIN EN 16247).
- Methods to identify, measure and manage energy consumption of exposed loads.
- Methods to analyze general cross-sectional technologies (compressed air, ventilation, cooling, process heating, lighting, heat recovery).
- Methods to identify and reduce the energy consumption of cross-sectional technologies (electricity and

other energy sources).

Literature:

Compulsory:

- BILGE, Ali Nezihi, 2015. *Energy systems and management* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-319-16024-5, 978-3-319-16023-8. Available via: https://doi.org/10.1007/978-3-319-16024-5.
- THORPE, David, 2014. *Energy management in industry: the Earthscan Expert Guide*. F. edition. London: Routledge, Taylor & Francis Group. ISBN 978-1-134-64941-9, 1-134-64941-X

Recommended:

None

Engineering Mathematics 1

Module abbreviation:	EMath1_ESYS	
Curriculum:	**Programmes**	
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 1	
Responsible for module:	Horák, Jiří	
Lecturers:	Horák, Jiří	
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:	1: Engineering Mathematics 1 (EMath1_ESYS)	
Lecture types:	1-Engineering Mathematics 1: SU/Ü - lecture with integrated exercises (EMath1_ESYS)	

Studien- / Prüfungsleistungen:

1-Engineering Mathematics 1: schrP120 - written exam, 120 minutes (EMath1_ESYS)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

1 Engineering Mathematics 1:

The students
- develop their ability to recognize which questions in engineering can be answered using mathematics and can ask such questions themselves.
- understand logical reasoning, recognize condition, consequence and rule, and they can build a chain of reasoning in the context of engineering applications.
- recognize known types of tasks in known and new contexts, can solve these tasks using known procedures.
- are able to understand the mathematical language used in engineering literature and describe their own reasoning and solution approaches orally and in writing.
- are able to deal confidently with the mathematical methods presented
- acquire a basic knowledge of number systems, their applications and the notion of convergence
- are able to apply differential and integral calculus to applications in engineering
- acquire a basic knowledge of differential equations and can solve related engineering problems

Content:

1 Engineering Mathematics 1:
- Complex numbers: Fundamentals, rules of calculation, applications
- Sequences and series: basics, convergence, applications
- Functions: Basics, continuity, applications
- Differential calculus in R: basics, differentiation rules, applications
- integral calculus in R: basics, integration methods, applications
- Ordinary differential equations: Fundamentals, solution methods, applications

Literature:
Compulsory:
None
Recommended:
• STRANG, Gilbert, 2017. *Calculus*. 3. edition. Wellesley, MA: Wellesley-Cambridge Press. ISBN 978-0-9802327-5-2
• THOMAS, George Brinton and others, 2018. *Thomas' calculus*. 14. edition. Boston: Pearson Education Limited. ISBN 978-93-530-6041-1
• SALAS, Saturnino L. and Einar HILLE, 1990. *Calculus: one and several variables*. 6. edition. New York [u.a.]: Wiley. ISBN 0-471-51751-8

Fluid Mechanics

Module abbreviation:	FluMech_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 21

Responsible for module:	Bschorer, Sabine
Lecturers:	Bschorer, Sabine (FluMech_ESYS) Bschorer, Sabine (FluMechAR_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:	21: Fluid Mechanics (FluMech_ESYS) 21.1: Fluid Mechanics (admission requirement) (FluMechAR_ESYS)
Lecture types:	21-Fluid Mechanics: SU/Ü/PR - seminar based teaching/Exercise course/laboratory (FluMech_ESYS) 21.1-Fluid Mechanics (admission requirement): SU/Ü/PR - seminar based teaching/Exercise course/laboratory (FluMechAR_ESYS)

Studien- / Prüfungsleistungen:

21-Fluid Mechanics: schrP90 - written exam, 90 minutes (FluMech_ESYS)

21.1-Fluid Mechanics (admission requirement): (Practical work), 2-7 experiments with 2-5 pages of documentation each (FluMechAR_ESYS)

Additional Explanation:

21 Fluid Mechanics:

LN = Successful completion of the credit certificate

21 Fluid Mechanics (admission requirement) (FluMechAR_ESYS):

Successful participation in 5 laboratory sessions and presentation of one exercise as a group

Recommended prerequisites:

None

Objectives:

21 Fluid Mechanics:

After attending the module courses, participants will be able to

- understand and use the technical terms;
- calculate analytically and evaluate either incompressible and compressible flow through pipes and around bodies;
- estimate analytically pressure losses and energy consumption of fluid mechanics problems;
- describe roughly the flow simulation (Computational Fluid Dynamics), in other words the digitalization in the field of fluid mechanics;
- deepen the lecture material during laboratory hours (learning by doing), to use flow measuring devices independently and to evaluate experiments.

21 Fluid Mechanics (admission requirement) (FluMechAR_ESYS):

The students deepen the lecture material during laboratory hours (learning by doing), to use flow measuring devices independently and to evaluate experiments.

Content:

21 Fluid Mechanics:
- Introduction and basic concepts
- Properties of fluids (density, viscosity)
- Hydrostatics and aerostatics
- Conservation equations (continuity, Bernoulli, lateral pressure, impulse conservation and Navier-Stokes-equations)
- Dimensionless quantities: Re, Ma-number
- Incompressible flow through bodies: viscous pipe flow, laminar vs. turbulent, pressure loss, pipe friction, non-circular sections, losses in pipeline elements (manifolds, nozzle)
- Incompressible flow around bodies: laminar vs. turbulent boundary layer, pressure and frictional resistance, aerodynamic forces on vehicles and aerofoils, Magnus effect
- Compressible flow: fundamental equations, pipe flow, process of outflow, de Laval nozzle
- Overview of flow simulation (approach, base equations, examples of use)
- Laboratory work about the topics as wind tunnel, flow around and through bodies

21 Fluid Mechanics (admission requirement) (FluMechAR_ESYS):
- Laboratory work about the topics: Wind tunnel, external and internal flow, wind turbine, supersonic flow
- Calculation of an exercise and presenting it to the group

Literature:

Compulsory:

None

Recommended:
- ÇENGEL, Yunus A., John M. CIMBALA and Mehmet KANOĞLU, 2020. *Fluid mechanics: fundamentals and applications*. F. edition. [Singapore]: McGraw-Hill. ISBN 978-981-315-788-0, 981-315-788-7
- JANNA, William S., 2016. *Introduction to fluid mechanics*. 5. edition. Boca Raton, Fla. [u.a.]: CRC Press, Taylor & Francis Group. ISBN 978-1-4822-1161-0
- KUNDU, Pijush K., Ira M. COHEN and David R. DOWLING, 2016. *Fluid mechanics*. 6. edition. Amsterdam [u.a.]: Elsevier/Academic Press. ISBN 0-12-405935-X, 978-0-12-405935-1
- FALKOVICH, Gregory, 2018. *Fluid mechanics* [online]. Cambridge: Cambridge University Press PDF e-Book. ISBN 978-1-316-41660-0. Available via: https://doi.org/10.1017/9781316416600.
- FALKOVICH, Gregory, 2018. *Fluid mechanics*. S. edition. Cambridge ; New York, NY ; Melbourne, VIC ; New Delhi ; Singapore: Cambridge University Press. ISBN 978-1-107-12956-6
- HUTTER, Kolumban, WANG, Yongqi, 2016. *Fluid and Thermodynamics: Volume 1: Basic Fluid Mechanics* [online]. Cham: Springer PDF e-Book. ISBN 978-3-319-33633-6, 978-3-319-33632-9. Available via: https://doi.org/10.1007/978-3-319-33633-6.
- HUTTER, Kolumban, WANG, Yongqi, 2016. *Fluid and Thermodynamics: Volume 2: Advanced Fluid Mechanics and Thermodynamic Fundamentals* [online]. Cham: Springer PDF e-Book. ISBN 978-3-319-33636-7, 978-3-319-33635-0. Available via: https://doi.org/10.1007/978-3-319-33636-7.
- HUTTER, Kolumban and Yongqi WANG, 2016. *Fluid and thermodynamics*. [Cham]: Springer.

Compulsory:

None

Recommended:

None

Machine Elements

Module abbreviation:	MachElem_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 13

Responsible for module:	Moll, Klaus-Uwe
Lecturers:	Moll, Klaus-Uwe
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:	13: Machine Elements (MachElem_ESYS)
Lecture types:	13-Machine Elements: SU/Ü - lecture with integrated exercises (MachElem_ESYS)

Studien- / Prüfungsleistungen:

13-Machine Elements: schrP90 - written exam, 90 minutes (MachElem_ESYS)

Additional Explanation:

None

Recommended prerequisites:

Statics, Basics of Mechanical Design, Mechanics of Materials, Material Science

Objectives:

13 Machine Elements:

At the end of the course, the students will be able to

- apply the terminology of the subject and discuss assignments with peers;
- to independently select and dimension the machine elements required for a design and to integrate it into an overall construction;
- apply the calculation and design methods for the treated machine elements on engineering level and to combine them with knowledge of statics, strength of materials, materials science and mechanical design;
- transfer the knowledge gained to other machine elements

Content:

13 Machine Elements:

- Fastening screws (stress diagram, proof of strength statically and dynamically)
- Pins and bolts (load bearing capacity, shear stress)
- Springs (static and dynamic proof of strength for coil springs, disk springs, torsion springs)
- Axles and shafts (design and fatigue strength)
- Shaft-hub connections (positive and positive shaft-hub connections)
- Rolling bearings (service life calculation, design of storage and bearing point)
- Spur gears (gear law, design of spur gears and simple gears)
- Clutches (switchable and non-switchable clutches)
- seals and lubrication
- Other machine elements

Literature:
Compulsory:

Compulsory:

- DECKER, Karl-Heinz, Frank RIEG and Karlheinz KABUS, 2018. *Maschinenelemente - Funktion, Gestaltung und Berechnung: mit 871 Bildern, 164 Berechnungsbeispielen und einem Tabellenband mit 334 Tabellen und Diagrammen*. 20. edition. München: Hanser. ISBN 978-3-446-45029-5, 3-446-45029-7
- DIN, 2021. *6885-1: Drive type fastenings without taper action, parallel keys, keyways - Deep pattern*. . Berlin: Beuth
- DIN, 2021. *6885-2: Drive type fastenings without taper action, parallel keys, keyways - Deep pattern for machine tools*. . Berlin: Beuth
- DIN, 2021. *6885-3: Drive type fastenings without taper action, parallel keys, keyways - Low pattern - Part 3: Dimensions, tolerances, mass*. . Berlin: Beuth
- DIN, 2012. *743-1: Calculation of load capacity of shafts and axles - Part 1: General*. . Berlin: Beuth
- DIN, 2012. *743-2: Calculation of load capacity of shafts and axles - Part 2: Theoretical stress concentration factors and fatigue notch factors*. . Berlin: Beuth
- DIN, 2012. *743-3: Calculation of load capacity of shafts and axles - Part 3: Strength of materials*. . Berlin: Beuth
- DIN, 2012. *743-4: Calculation of load capacity of shafts and axles - Part 4: Fatigue limit, endurance limit - Equivalently damaging continuous stress*. . Berlin: Beuth

Recommended:

None

Measurement Engineering

Module abbreviation:	MeasmEng_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 22

Responsible for module:	Müller, Dieter
Lecturers:	Schwerd, 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:	22: Measurement Engineering (MeasmEng_ESYS)
Lecture types:	22-Measurement Engineering: SU/Ü/PR - seminar based teaching/Exercise course/laboratory (MeasmEng_ESYS)

Studien- / Prüfungsleistungen:

22-Measurement Engineering: schrP90 - written exam, 90 minutes (MeasmEng_ESYS)

Additional Explanation:

None

Recommended prerequisites:

Engineering mathematics 1 and 2

Objectives:

22 Measurement Engineering:

Students will

- know the basic terms of measurement technology
- know important measuring sensors and their characteristics for frequently occurring measured quantities in mechanical engineering
- understand data sheets of measuring elements and devices
- can select suitable measuring elements and devices for measuring tasks
- can estimate, determine and evaluate measurement deviations
- can apply the distribution function, also beyond measurement technology

Content:

22 Measurement Engineering:

- Basic terms of measurement technology
- Measurement deviations including:
- Statistical principles for the treatment of random deviations.
- Error propagation, - linear regression, - dynamic behavior and dynamic deviations of measuring elements
- Measurement of mechanical quantities
- Measurement of electrical quantities, digital measurement, measurement systems
- Temperature measurement
- Flow measurement
- Special sensors

Literature:
Compulsory:
None
Recommended:
• MATILDA, S. and others, 2021. *Basic Electrical Electronics and Measurement Engineering*. Chennai: Ugam Books. ISBN 8194482543
• BALAYI, B. and others, 2021. *Basic Electrical, Electronics and Instrumentation Engineering*. Chennai: Ugam Books. ISBN 8194482550

Mobility within the Energy System

Module abbreviation:	MobES_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 29

Responsible for module:	Huber, Matthias
Lecturers:	Gelner, Alexander; Holzhammer, Uwe Abraham; Nonte, Laura; Schweizer, Manuel; Zade, Michel
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: Mobility within the Energy System (MobES_ESYS)
Lecture types:	29-Mobility within the Energy System: SU/Ü/PR - seminar based teaching/Exercise course/laboratory (MobES_ESYS)

Studien- / Prüfungsleistungen:

29-Mobility within the Energy System: SA - seminar paper with written composition (written composition 8 - 15 pages) and presentation (15 - 20 pages) (MobES_ESYS)

Additional Explanation:

None

Recommended prerequisites:

Basic battery knowledge
Basic knowledge of energy economics
Basic knowledge of renewable energies
Basic knowledge of business administration

Combination with other lectures/topics
Builds on and deepens other lectures:
o Energy distribution and CHP
o Smart Grids and Wind Energy
o Energy systems and energy economics
o Energy markets and sector coupling (very important)

Objectives:

29 Mobility within the Energy System:

The students

- will have knowledge of different technologies for reducing CO2 emissions in the field of mobility, like electromobility, renewable gases (methane and hydrogen) and renewable liquid fuels
- will be able to classify the different technologies and evaluate their interactions with the energy system as well as their economic impacts
- will also be able to evaluate the electrical loads resulting from "fuel production" using renewable electricity
- will understand in detail the technological and economical aspects of E-mobility and its impact on the energy system
- will have an overview of possible changes in future mobility on the energy system areas: power generation, grid and consumption

Content:

29 Mobility within the Energy System:

Future mobility

- From the perspective of electricity demand
- Presentation of mobility options
- CO_2 emissions and CO_2 reduction

Legal and regulatory framework:

- Promotion of e-mobility
- Biofuel quota law, sustainability requirement
- Grid fees (electricity, gas), levies, taxes, energy tax
- Emission reduction requirements, fleet consumption
- Promotion of e-vehicles and promotion of gas-powered vehicles

The different energy sources for the mobility of the future are discussed:

Liquid fuels in internal combustion engines (overview):

- Biofuels (overview only, review of biomass lecture).
    - Ethanol in mobility, ethanol production
    - Biodiesel in mobility, biodiesel production
    - Second generation fuels (fuels from residues)
- Synthetic fuels
    - Synthetic fuels
    - Power to Liquid

E-mobility:

- Technology
- Effect on the power grid
- Billing

Gas Mobility:

- Introduction to gas vehicle technology using internal combustion engine and fuel cell:
- Tank technology
- Renewable gas production

Literature:

Compulsory:

- DOPPELBAUER, Martin , 2024. *Introduction to Electromobility*. 2025. edition. Wiesbaden: Springer. ISBN 978-3-658-45481-4
- KLELL, Manfred , 2023. *Hydrogen in Automotive Engineering*. 1. edition. Wiesbaden: Springer. ISBN 978-3-658-45481-4
- HEYWOOD, John , 2018. *Internal Combustion Engines Fundamentals*. 1. edition. New York: McGrawHill Education. ISBN 978-1-26-011610-6

Recommended:

- Further literature will be announced in the lecture.

Statics

Module abbreviation:	ST_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 7

Responsible for module:	Feifel, Elke
Lecturers:	Feifel, Elke
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: Statics (ST_ESYS)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

7-Statics: schrP90 - written exam, 90 minutes (ST_ESYS)

Additional Explanation:

7 Statics:

None

Recommended prerequisites:

None

Objectives:

7 Statics:

The students

- understand the principles and methods of the statics of rigid bodies and can apply these to mechanical engineering tasks
- are able to convert real components and structures into simplified mechanical equivalent models
- are able to analyze the loads acting on a mechanical system
- are able to calculate the bearing reactions and internal loads of statically determined structures under static loads
- are able to work on three-dimensional problems
- can calculate centers of gravity of lines, areas and volumes
- understand the basic concept of friction and can solve problems relating to this
- know the basic concepts of statics and can express themselves competently in the subject area
- are able to confidently apply mathematical principles to calculations
- have a capacity for abstraction and can solve tasks independently and in a team in a structured manner

Content:

7 Statics:

- Introduction to the basics of statics (bars, beams, plates, bearings and hinges, equilibrium conditions)
- Central and common force systems
- Analysis of mechanical structures, including trusses
- Forces, moments, resultants, support reactions
- Internal forces and moments
- Spatial mechanical systems

- Center of gravity
- Friction

Literature:

Compulsory:

None

Recommended:

- GROSS, Dietmar and others, 2013. *Engineering Mechanics Statics*. 2. edition. Dordrecht: Springer. ISBN 978-3-662-53853-1
- HIBBELER, Russel C., 2016. *Engineering Mechanics: Statics in SI Units*. 14. edition. Hoboken: Pearson. ISBN 1-292-08923-7, 978-1-292-08923-2
- KESSEL, Siegfried and Dirk FRÖHLING, 2012. *Technische Mechanik - Engineering Mechanics Zweisprachiges Lehrbuch zu Grundlagen der Mechanik fester Körper - Bilingual Textbook on the Fundamentals of Solid Mechanics*. 2. edition. Wiesbaden: Springer. ISBN 978-3-8348-1719-8

System Analysis and Control - Master

Module abbreviation:	SysAnaCon_M-RES

Curriculum:	**Programmes**
	Master RES (M-Res) - SPO-Nr.: 2

Responsible for module:	Navarro Gevers, Daniel
Lecturers:	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:	2: System Analysis and Control (SysAnaCon_M-RES)
Lecture types:	2-System Analysis and Control: SU/Ü - lecture with integrated exercises (SysAnaCon_M-RES)

Studien- / Prüfungsleistungen:

2-System Analysis and Control: schrP90 - written exam, 90 minutes (SysAnaCon_M-RES)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

2 System Analysis and Control:

The students

- can model a physical system.
- Can characterize a control loop understanding what is the controller, the actuator, the measurement device and the system,
- Can take a decision on the dynamic needs of a system response
- Understands different methods of tuning the controllers to fulfill the dynamic demands
- Know the different controller types and can decide which controller is needed for each case.
- are able to apply different controller tuning methods and are able to predict the dynamic behavior of a system
- are able to evaluate and discuss simulation results with respect to theory and experiments
- can take the decision of existing hardware to design a given

Content:

2 System Analysis and Control:

- System description
- Definition of a control loop
- Stability in a control loop
- Transfer function
- Frequency response
- Main control variables
- Root locus method
- Alternative Design Methods

- Design variables in a control system (calculation frequency, sample frequency, variables to be measured etc.)
- Response of first order and second order Systems
- Speed Control of a Wind turbine
- Frequency control in an electrical grid
- Application to practical problems (computer lab Matlab)

Literature:

Compulsory:

- OGATA, Katsuhiko, 2010. *Modern control engineering*. 5. edition. Boston [u.a.]: Pearson. ISBN 978-0-13-713337-6, 0-13-713337-5

Recommended:

None

Thermodynamics 2

Module abbreviation:	ThermDyn2_ESYS

Curriculum:	**Programmes**
	Energy Systems and Renewable Energies (ESYS-B) - SPO-Nr.: 20

Responsible for module:	Bschorer, Sabine
Lecturers:	Dallner, Rudolf
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:	20: Thermodynamics 2 (ThermDyn2_ESYS)
Lecture types:	20-Thermodynamics 2: SU/Ü/PR - seminar based teaching/Exercise course/laboratory (ThermDyn2_ESYS)

Studien- / Prüfungsleistungen:

20-Thermodynamics 2: schrP90 - written exam, 90 minutes (ThermDyn2_ESYS)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

20 Thermodynamics 2:

The students are expected to acquire the following competences:

- Derivation of differential equations of heat conduction on a volume element and to solve these with given local/temporal boundary conditions
- Characterization of fluids using similarity parameters in order to calculate the heat transfer coefficient by means of appropriate Nusselt correlations
- Ability to plot temperature profiles in heat exchangers depending on the operating conditions and knowledge in the use of characteristic diagrams to design heat exchangers or to evaluate feasible exit temperatures.
- Principles of electro-magnetic heat radiation and application of black and grey body radiation formula in order to approximate the heat transport of high temperature solids
- Practice in solution strategies of heat transfer problems with review of given exams in additional tutorial courses
- Application of heat transfer mechanisms in the practical laboratory course

Content:

20 Thermodynamics 2:

Heat exchange by heat conduction

- Fourier differential equation (heat conduction equation)
- One-dimensional steady heat conduction
- One-dimensional transient heat conduction

Heat transfer by convection

- Basics of thermo fluid dynamics
- Forced convection

- Natural convection
- Heat exchangers

Heat transfer by radiation

- Basic concepts of radiation
- Solid body radiation

Practical laboratory course

- Test preparation
- Test realisation

Test evaluation

Literature:

Compulsory:

None

Recommended:

- INCROPERA, Frank P. and others, 2017. *Incropera's principles of heat and mass transfer*. G. edition. Hoboken, NJ: Wiley. ISBN 978-1-119-38291-1, 1-119-38291-2
- KARWA, Rajendra, 2020. *Heat and Mass Transfer* [online]. Singapore: Springer Singapore PDF e-Book. ISBN 978-981-153-988-6. Available via: https://doi.org/10.1007/978-981-15-3988-6.
- VENKATESHAN, S.P., 2021. *Heat Transfer* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-030-58338-5. Available via: https://doi.org/10.1007/978-3-030-58338-5.
- NELLIS, G. F. and S. A. KLEIN, 2021. *Introduction to engineering heat transfer*. Cambridge: Cambridge University Press. ISBN 978-1-107-17953-0

Course Descriptions

Engineering and Management

This program and course description becomes effective on 01.10.2024. 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

Design Leadership - Master

Fach	SWS	ECTS
Advanced Management Theory and Methods	4	6

Engineering and Management

Fach	SWS	ECTS
Automation Technologies	4	5
Business Administration	4	5
Cost Accounting	4	5
Engineering Mechanics	5	5
Mathematics 1	5	5
Software Development	4	5

Module Descriptions

Advanced Management Theory and Methods - MASTER

Module abbreviation:	AdMana_M-DL

Curriculum:	**Programmes**
	Design Leadership (M-DL) - SPO-Nr.: 3

Responsible for module:	Schneider, Yvonne
Lecturers:	Schneider, Yvonne
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:	3: Advanced Management Theory and Methods (AdMana_M-DL)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

3-Advanced Management Theory and Methods: schrP90 - written exam, 90 minutes (AdMana_M-DL)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

3 Advanced Management Theory and Methods:

By actively participating in this course, students:

- are able to understand the basic elements of management in corporations.
- are familiar with structures and processes in companies.
- are aware of different roles and responsibilities in organizations.
- understand decision-making processes in corporations.
- know the key elements of a corporate strategy development in a company and the respective planning processes.
- are aware of key strategy tools for analysis and should become able to use them.
- get familiar with management accounting and financial tools of companies such as profit and loss statements, key performance indicators etc.
- learn about functional aspects of a corporation, such as production or human resource management.
- receive input how to exploit market opportunities via marketing activities.
- obtain information on how to bring an idea to a start-up based on entrepreneurial activities.
- gain ability to critically reflect corporate activities and decisions.

Cases, examples and calculation exercises are integrated through the course to reinforce and to clarify major topics.

Content:

3 Advanced Management Theory and Methods:

This module provides a general overview on theory, methods and challenges of Management. Among others, the following aspects will be discussed:

- Leading the Organization
- Developing Strategic Foresight

• Managing Financial performance
• Exploiting Market opportunities
• Excursus: Managing Start-up Activities

Literature:

Compulsory:

- ROBBINS, Stephan P. and Mary COULTER, 2021. *Management*. ISBN 978-1-292-34088-3

Recommended:

- NICKELS, William G., James M. MCHUGH and Susan M. MCHUGH, 2022. *Understanding business*. T. edition. New York, NY: McGraw-Hill. ISBN 978-1-266-04322-2, 1-266-04322-5

Automation Technologies

Module abbreviation:	AUT_EGM

Curriculum:	**Programmes**
	Engineering and Management (EGM-B) - SPO-Nr.: 26

Responsible for module:	Großmann, Daniel
Lecturers:	Großmann, 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:	26: Automation Technologies (AUT_EGM)
Lecture types:	SU/Ü/Pr-Lecture with exercises and practical courses

Studien- / Prüfungsleistungen:

26-Automation Technologies: schrP90 - written exam, 90 minutes (AUT_EGM)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

26 Automation Technologies:
The students
- have a basic understanding of automation technology
- recognise automation potential and the demand for automation
- have a basic understanding of information and communication technology in automation systems

Content:

26 Automation Technologies:
- Basics of industrial process and control
- Sensors and actuators
- Automation controller
- Programming of automation controllers (with exercise)
- Operation and monitoring
- Industrial communication
- Development of automation systems

Literature:

Compulsory:
None
Recommended:
None

Business Administration

Module abbreviation:	BA_EGM_E

Curriculum:	**Programmes**
	Engineering and Management (EGM-B) - SPO-Nr.: 9

Responsible for module:	Eisenberg, Andrea
Lecturers:	Albrecht, Tobias; 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:	9: Business Administration (BA_EGM_E)
Lecture types:	SU/Ü-Lecture with exercises

Studien- / Prüfungsleistungen:

9-Business Administration: schrP90 - written exam, 90 minutes (BA_EGM_E)
Additional Explanation:
None

Recommended prerequisites:

Objectives:

9 Business Administration:

The students
- understand (on a high level) the various disciplines of business administration including the respective decision needs
- learn how to judge situations using a business logic and specifically how to evaluate projects or investments
- develop a basis for subsequent management subjects included in the curriculum (accounting, controlling, marketing)
- learn about selected practical business topics, which are not covered in subsequent subjects of the curriculum, including the setup of a company and human resource management

Content:

9 Business Administration:
- The subject of business administration, incl. economic principle, resources, companies, business as a science
- Profit generation: the term profit, limitations, balance sheet, profit-/loss statement, shareholder value, entrepreneurial risks, leverage effect
- Setup of a company - factors of production (management, labour, means of production, raw material), further differentiation of management activities (leadership, planning, decision making, organization, monitoring)
- Setup of a company - legal form, alliances & partnering, choice of industrial location
- Human resource management: planning, recruiting, personnel layoff, personnel deployment, development, leadership

Literature:

Compulsory:

None
Recommended:
None

Cost Accounting

Module abbreviation:	COSTA_EGM	
Curriculum:	**Programmes**	
	Engineering and Management (EGM-B) - SPO-Nr.: 18	
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:	18: Cost Accounting (COSTA_EGM)	
Lecture types:	SU/Ü-Lecture with exercises	

Studien- / Prüfungsleistungen:

18-Cost Accounting: schrP90 - written exam, 90 minutes (COSTA_EGM)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

18 Cost Accounting:

Students

- know and use the specific terms of cost accounting,
- understand the purpose of cost accounting and the difference between financial accounting and cost accounting,
- can classify cost by nature of cost, by traceability of cost and by cost behaviour,
- can prepare a simple calculation of inventory, COGS and price based on a blanket rate,
- can perform an allocation and apportionment of overhead cost with a cost allocation sheet based on absorption costing and can calculate departmental overhead rates based on the results
- can calculate the unit cost based on different versions of process costing and based on different versions of job order costing,
- understand the concept of variable costing and the meaning of the contribution margin,
- understand how variable costing is applied to make a short-term decision and can solve a real-life case based on contribution analysis, can apply economies of scale, can prepare a break-even analysis, can determine product portfolios and can make manufacturing process decisions,
- understand the importance of standard costing, can prepare a static and a flexible budget and can calculate and interpret different types of variances, and
- understand the meaning of comparative cost accounting

Content:

18 Cost Accounting:

- Difference between financial and cost accounting
- Classification of cost according to nature, traceability and behaviour
- Absorption costing: blanket rate, allocation and apportionment of overhead cost with cost allocation sheet, process costing, job order costing with planet-wide allocations rate, departmental overhead rate

and machine hour rates
- Variable costing: contribution margin, direct costing, multi-step contribution analysis, decision making with contribution margin, economies of scale, pricing decisions, break-even analysis, product mix, production process selection
- Standard costing: purpose of standard costing, static and flexible budget, variance analysis
- International comparison of accounting applications
- Casework

Literature:
Compulsory:
None
Recommended:
None

Engineering Mechanics

Module abbreviation:	EngMECH_EGM

Curriculum:	**Programmes**
	Engineering and Management (EGM-B) - SPO-Nr.: 15

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:	15: Engineering Mechanics (EngMECH_EGM)
Lecture types:	S/Pr-Seminar/Practical course

Studien- / Prüfungsleistungen:

15-Engineering Mechanics: schrP90 - written exam, 90 minutes (EngMECH_EGM)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

15 Engineering Mechanics:
The students
- get knowledge in the effects of forces and moments
- are able to get to the root of static problems
- use equilibrium equations
- determine competent outer and inner load reactions
- solve friction problems
- estimate stresses, strains and deformations of bars and beams
- get insight in the theory of elasticity
- transfer their knowledge to the analytical strength assessment of components in mechanical engineering

Content:

15 Engineering Mechanics:
- Introduction to the basics of statics (bars, beams, plates, etc., bearings and hinges, equilibrium conditions)
- Central and common force systems, free-body diagram, moments
- Balance points, centroids
- Supporting structures
- Determinacy
- Truss structures
- Friction
- Definition of stresses and strains, deformation, stress state, Mohr's circle
- Linear elastic material law, elasticity theory

- Combined loading
- bending of beams, stress and deformation
- Torsion, stress and deformation
- Extensive examples and exercises for a competent application to engineering tasks

Literature:

Compulsory:

- GROSS, Dietmar, Band 12013. *Engineering mechanics* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-3-642-30319-7. Available via: https://doi.org/10.1007/978-3-642-30319-7.
- 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.

Recommended:

- GROSS, Dietmar, GROSS, Dietmar, HAUGER, Werner. *Technische Mechanik Band 1-4* [online]. PDF e-Book.
- GROSS, Dietmar and others, 2017. *Statics – formulas and problems : engineering mechanics 1* . Berlin, Heidelberg: Springer. ISBN 978-3-662-53854-8
- HIBBELER, Russell C. and Jun Hwa LEE, 2023. *Engineering mechanics, statics*. F. edition. Harlow, UK: Pearson. ISBN 1-292-44404-5, 978-1-292-44404-8
- KESSEL, Siegfried, FRÖHLING, Dirk, 2012. *Technische Mechanik: zweisprachiges Lehrbuch zu Grundlagen der Mechanik fester Körper = Engineering mechanics : bilinual textbook ont the fundamentals of solid mechanics* [online]. Wiesbaden: Springer Vieweg PDF e-Book. ISBN 978-3-8348-2182-9. Available via: https://doi.org/10.1007/978-3-8348-2182-9.
- GABBERT, Ulrich, RAECKE, Ingo, 2013. *Technische Mechanik für Wirtschaftsingenieure: mit 301 Abbildungen, 16 Tabellen, 83 Beispielen* [online]. München: Hanser PDF e-Book. ISBN 978-3-446-43595-7, 978-3-446-43253-6. Available via: https://doi.org/10.3139/9783446435957.
- HIBBELER, Russell C., 2018. *Mechanics of materials*. T. edition. Harlow: Pearson. ISBN 978-1-292-17828-8

Mathematics 1

Module abbreviation:	MA1_EGM_E

Curriculum:	**Programmes**
	Engineering and Management (EGM-B) - SPO-Nr.: 1

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:	1: Mathematics 1 (MA1_EGM_E)
Lecture types:	SU/Ü-Lecture with exercises

Studien- / Prüfungsleistungen:

1-Mathematics 1: schrP120 - written exam, 120 minutes (MA1_EGM_E)

Additional Explanation:

None

Recommended prerequisites:

Objectives:

1 Mathematics 1:

Students:

- have 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 introduced mathematical methods;
- are capable to apply a software system to support the solution of mathematical problems.

Content:

1 Mathematics 1:

- Complex numbers: basics, rules, applications
- Sequences and series: basics, convergence, applications
- Functions and differential calculus: basics, elementary functions continuity, derivatives, applications
- Power series: basics, Taylor development, radius of convergence, applications
- Integration in R: basics, methods of integration, applications

Literature:

Compulsory:

- STRANG, Gilbert, 2010. *Calculus*. 2. edition. Wellesley, Mass.: Wellesley-Cambridge Press. ISBN 978-0-9802327-4-5

- STEWART, James, 2016. *Calculus*. 8. edition. Belmont, Calif.: Thomson Brooks/Cole. ISBN 978-1-305-26672-8, 1-305-26672-2

Recommended:

- ARENS, Tilo, 2015. *Mathematik* [online]. Berlin [u.a.]: Springer Spektrum PDF e-Book. ISBN 978-3-642-44919-2, 978-3-642-44918-5. Available via: https://doi.org/10.1007/978-3-642-44919-2.
- WEITZ, Edmund and Heike STEPHAN, 2021. *Konkrete Mathematik (nicht nur) für Informatiker: mit vielen Grafiken und Algorithmen in Python*. 2. edition. Berlin: Springer Spektrum. ISBN 978-3-662-62617-7
- KARPFINGER, Christian, 2022. *Höhere Mathematik in Rezepten: Begriffe, Sätze und zahlreiche Beispiele in kurzen Lerneinheiten*. 4. edition. Berlin: Springer Berlin. ISBN 978-3-662-63304-5, 3-662-63304-3
- KOCH, Jürgen and Martin STÄMPFLE, 2018. *Mathematik für das Ingenieurstudium*. 4. edition. München: Hanser. ISBN 978-3-446-45166-7, 3-446-45166-8

Software Development

Module abbreviation:	SWD_EGM

Curriculum:	**Programmes**
	Engineering and Management (EGM-B) - SPO-Nr.: 14

Responsible for module:	Schiendorfer, Alexander
Lecturers:	Lodes, Lukas; Schiendorfer, Alexander
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:	14: Software Development (SWD_EGM)
Lecture types:	SU/Ü/Pr-Lecture with exercises and practical courses

Studien- / Prüfungsleistungen:

14-Software Development: schrP90 - written exam, 90 minutes (SWD_EGM)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

14 Software Development:

The students gain a practical understanding of the field of software development as an engineering tool to solve problems. After completing the module they are able to:

- design, build, and test software applications using the Python programming language
- understand and document customer requirements and solve problems using coding/technology
- communicate the architecture of their software effectively to a team of software developers
- improve and debug existing code
- use automated tests to make sure the software is implemented correctly
- understand the need to work with other professionals, e.g. UX designer, graphic designer, product manager, technical writer

Content:

14 Software Development:

- Application areas of software development: mobile apps, web applications, tools for automation of repeating tasks, smart factories, artificial intelligence, etc.
- The Python programming language
- Variables, conditional statements, functions and code reuse
- Data structures: Lists, dictionaries
- Effective testing and debugging
- Object-oriented analysis & design (Inheritance, Polymorphism)
- Simple algorithms and an informal introduction to algorithmic complexity
- Development of user-friendly graphical user interfaces
- The whole software development process from analysis to testing

Literature:
Compulsory:
None
Recommended:
• KLEIN, Bernd, 2021. *Einführung in Python 3: für Ein- und Umsteiger*. 4. edition. München: Hanser. ISBN 978-3-446-46556-5
• PILONE, Dan and Russ MILES, 2008. *Head first software development: [a brain-friendly guide]*. [. edition. Beijing [u.a.]: O'Reilly. ISBN 0-596-52735-7, 978-0-596-52735-8
• FREEMAN, Eric and Elisabeth ROBSON, 2020. *Head first design patterns*. S. edition. ISBN 978-1-492-07800-5

Course Descriptions

Electrical Engineering and Information Technology

International Office

Winter term 2024/25

As per: 2024-08-07

This program and course description becomes effective on 01.10.2024. 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

Fach	SWS	ECTS
Artificial Intelligence and Automotive Systems	4	5
Automotive Control Engineering	4	5
Automotive Electronics	4	5
Data Engineering and Analytics	4	5
Sensor Networks Technologies and Sensor Data Fusion	4	5
Knowledge Modeling and Machine Learning	4	5

Automated Driving and Vehicle Safety

Fach	SWS	ECTS
Sensor Networks Technologies and Sensor Data Fusion	4	5
Sensor Technology and Signal Processing	4	5
Knowledge Modeling and Simulation	4	5

Autonomous Vehicle Engineering

Fach	SWS	ECTS
Digital Signal Processing	6	7
Practical Course Digital Signal Processing	2	0
Embedded Systems	4	5
Modelling and Simulation	6	7
Practical Course Modelling and Simulation	2	0

International Automotive Engineering - Master

Fach	SWS	ECTS
Automotive Control Engineering	4	5
Automotive Electronics	4	5
Knowledge Modeling and Machine Learning	4	5
Mathematical Modelling and Simulation	4	5
Matlab/Simulink for Automotive System Design	4	5
Power Supply and Energy Distribution	4	5
Power Train	4	5
Sensor Technology and Signal Processing	4	5
Vehicle Crash Mechanics and Biomechanics	4	5

2   Module Descriptions

Artificial Intelligence and Automotive Systems - Master

Module abbreviation:	IAE_AIAS

Curriculum:	**Programmes**
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 12

Responsible for module:	DaSilva, Joed Lopes
Lecturers:	DaSilva, Joed Lopes; Zimmer, Alessandro
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:	12: Artificial Intelligence and Automotive Systems (IAE_AIAS)
Lecture types:	12-Artificial Intelligence and Automotive Systems: SU/Ü - lecture with integrated exercises (IAE_AIAS)

Studien- / Prüfungsleistungen:

12-Artificial Intelligence and Automotive Systems: LN - written exam, 90 minutes (IAE_AIAS)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

12 Artificial Intelligence and Automotive Systems:

After successfully completing the module the students shall be able to

- understand the basic principles that lie behind different Artificial Intelligence techniques that can be used in the context of automotive systems.
1. identify the most suitable Artificial Intelligence techniques to be used in a given scenario.
2. model a problem of automotive safety using Artificial Intelligence systems.
3. implement basic intelligent algorithms in Matlab.

Content:

12 Artificial Intelligence and Automotive Systems:

- Introduction to AI. Problems and search space. Knowledge representation and Pattern Recognition.
4. AI and Automotive Systems/Automotive Safety Systems.
5. Theory, concepts and applications of Neural Networks. Neurodynamics, topology of Neural Networks and learning methods.
6. Fuzzy sets and systems. Modelling of Fuzzy System's Applications.
7. Concepts of Evolutionary Systems. Genetic Algorithms and optimization problems.

Literature:

Compulsory:

None

Recommended:

- RUSSELL, Stuart J. and Peter NORVIG, 2021. *Artificial intelligence: a modern approach*. F. edition. Hoboken: Pearson. ISBN 978-0-13-461099-3

8. MICHELUCCI, Umberto, 2018. *Applied deep learning: a case-based approach to understanding deep neural networks* [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.

9. SINGH, Himanshu, LONE, Yunis Ahmad, 2020. *Deep Neuro-Fuzzy Systems with Python: With Case Studies and Applications from the Industry* [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.

10. 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

11. 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 Control Engineering - Master

Module abbreviation:	IAE_ACE

Curriculum:	**Programmes**
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 12 International Automotive Engineering (IAE-M) - SPO-Nr.: 7

Responsible for module:	Gregor, Rudolf
Lecturers:	Gregor, Rudolf
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:	12: Automotive Control Engineering (IAE_ACE)
Lecture types:	12-Automotive Control Engineering: SU/Ü - lecture with integrated exercises (IAE_ACE)

Studien- / Prüfungsleistungen:

12-Automotive Control Engineering: schrP90 - written exam, 90 minutes (IAE_ACE)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

12 Automotive Control Engineering:

After successfully completing the module students are able to

- analyze and describe systems in time and frequency domain
12. select and design controllers based on classical control engineering methods (root locus, bode diagram)
13. model and analyze LTI-systems in state space
14. design state space controllers for SISO and MIMO-systems using different methods (pole placement, modal control, optimal control)
15. design observers for LTI-systems
16. solve simple control tasks for non-linear systems

Content:

12 Automotive Control Engineering:

- Repetition of classical control engineering methods
17. State space representation of linear time invariant systems (SISO and MIMO)
18. Analysis of system properties (dynamics, stability, (output) controllability, observability) in state space
19. Calculation of the state transition matrix to solve the state equation
20. Design of state feedback control (pole placement, modal control, optimal control) to improve system dynamics
21. Design og prefilters and integral action for static accuracy
22. Design of state observers
23. Representation and analysis of non-linear control systems
24. Lab work: Design and test of different types of control systems by use of Matlab-Simulink

Literature:

Compulsory:

- GREGOR, Rudolf, KRÄMER, Wolfgang, 2023. *Slides, exercises, supplementary material.* [online]. PDF e-Book.

Recommended:

- BOLTON, William, 2010. *Control engineering*. 2. edition. Harlow u.a.: Prentice Hall. ISBN 978-0-582-32773-3

25. BURNS, Roland S., 2001. *Advanced control engineering*. 1. edition. Oxford [u.a.]: Butterworth-Heinemann. ISBN 0-7506-5100-8

26. FRANKLIN, Gene F., J. David POWELL and Abbas EMAMI-NAEINI, 2020. *Feedback control of dynamic systems*. E. edition. Upper Saddle River, NJ [u.a.]: Pearson. ISBN 978-1-292-27452-2, 1-292-27452-2

27. DORF, Richard C. and Robert H. BISHOP, 2022. *Modern control systems*. F. edition. Harlow, United Kingdom: Pearson. ISBN 978-1-292-42235-0

Automotive Electronics - Master

Module abbreviation:	IAE_AES

Curriculum:	**Programmes**
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 12 International Automotive Engineering (IAE-M) - SPO-Nr.: 5

Responsible for module:	Arnold, Armin
Lecturers:	Arnold, Armin
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:	12: Automotive Electronics (IAE_AES)
Lecture types:	12-Automotive Electronics: SU/Ü - lecture with integrated exercises (IAE_AES)

Studien- / Prüfungsleistungen:

12-Automotive Electronics: schrP90 - written exam, 90 minutes (IAE_AES)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

12 Automotive Electronics:

After successfully completing the module, the students have a

- knowledge of automotive electronics architectures
28. knowledge of the architecture of automotive control units and applied integrated circuits
29. knowledge of automotive sensor technologies
30. kowledge of automotive actuator technologies
31. comprehension of the functional dependencies
32. ability to apply the knowledge to specify and design control units

Content:

12 Automotive Electronics:

- basics of electrical and electronic engineering
33. recapitulation of microcontroller technology
34. control unit circuits for input and sensor signal conditioning, output drivers and controlling actuators, power supply
35. physical layer of automotive communication networks and onboard communication
36. introduction to automotive electric standards
37. basics of automotive sensors and actuators
38. basics of automotive software engineering

Literature:

Compulsory:

None

Recommended:

- ZAMAN, Najamuz, 2015. *Automotive electronics design fundamentals* [online]. Cham [u.a.]: Springer PDF e-Book. ISBN 978-3-319-17584-3, 978-3-319-17583-6. Available via: http://dx.doi.org/10.1007/978-3-319-17584-3.

39. IDA, Nathan, 2015. *Engineering electromagnetics* [online]. Cham [u.a.]: Springer PDF e-Book. ISBN 978-3-319-07806-9, 978-3-319-07805-2. Available via: http://dx.doi.org/10.1007/978-3-319-07806-9.

40. 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: http://dx.doi.org/10.1007/978-3-658-01784-2.

Data Engineering and Analytics - Master

Module abbreviation:	AI_DataEng

Curriculum:	**Programmes**
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 3

Responsible for module:	Schmidtner, Stefanie
Lecturers:	Schmidtner, Stefanie
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: Data Engineering and Analytics (AI_DataEng)
Lecture types:	3-Data Engineering and Analytics: SU/Ü - lecture with integrated exercises (AI_DataEng)

Studien- / Prüfungsleistungen:

3-Data Engineering and Analytics: schrP90 - written exam, 90 minutes (AI_DataEng)

Additional Explanation:

None

Recommended prerequisites:

Probability and Statistics, Concept of Random Variables; Linear Algebra; Analysis

Objectives:

3 Data Engineering and Analytics:

Data analytics and data engineering are fundamental fields for the development of automated systems. The aim of the lecture is to give students a sound understanding of data analytics methods and to convey fundamentals in data engineering.

After finishing this course including excercises students are able to

- choose and calculate appropriate metrics and visualizations for describing a data set.
41. understand and master fundamental data analysis and machine learning methods.
42. have deep knowledge about model assessment and inference techniques for linear and non-linear models.
43. know fundamentals of data engineering.

Content:

3 Data Engineering and Analytics:

- Data visualization
44. Data cleaning and data quality
45. Fundamentals of statistical learning and machine learning
46. Linear Regression
47. Classification
48. Model assessment, selection and inference: Cross-Validation & Bootstrap
49. Decision Trees
50. Unsupervised Learning
51. Neural networks (ANN, ResNet, CNN)
52. Fundamentals of data engineering (data modeling, data warehouse, data lake, parallel and distributed

computing, data pipelines)
Literature:
Compulsory: None *Recommended:* • WILKE, Claus, March 2019. *Fundamentals of data visualization: a primer on making informative and compelling figures*. 1. edition. Beijing: O'Reilly. ISBN 978-1-492-03108-6 53. JAMES, Gareth, WITTEN, Daniela, HASTIE, Trevor, TIBSHIRANI, Robert, TAYLOR, Jonathan, 2023. *An Introduction to Statistical Learning: with Applications in Python* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-031-38747-0. Available via: https://doi.org/10.1007/978-3-031-38747-0. 54. HASTIE, Trevor, TIBSHIRANI, Robert, FRIEDMAN, Jerome H., 2017. *The elements of statistical learning: data mining, inference, and prediction* [online]. New York, NY, USA: Springer PDF e-Book. ISBN 978-0-387-84858-7. Available via: https://doi.org/10.1007/978-0-387-84858-7. 55. BISHOP, Christopher M., 2009. *Pattern recognition and machine learning*. 8. edition. New York [u.a.]: Springer. ISBN 0-387-31073-8, 978-1-4939-3843-8 56. LESKOVEC, Jure, Anand RAJARAMAN and Jeffrey D. ULLMAN, 2020. *Mining of massive datasets*. T. edition. Cambridge: Cambridge University Press. ISBN 978-1-108-47634-8 57. RYZA, Sandy and others, 2017. *Advanced analytics with Spark: patterns for learning from data at scale*. S. edition. Beijing: O'Reilly. ISBN 978-1-4919-7295-3

Digital Signal Processing

Module abbreviation:	AVE_PractDiSigProc

Curriculum:	**Programmes**
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 13 Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 13

Responsible for module:	Mecking, Michael
Lecturers:	Mecking, Michael
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:	13.2: Practical Course Digital Signal Processing (AVE_PractDiSigProc)
Lecture types:	SU/Ü - seminar class/exercise; Pr - practical course;

Studien- / Prüfungsleistungen:

13.2-Practical Course Digital Signal Processing: LN - participation without/with success (AVE_PractDiSigProc)

Additional Explanation:

13 Practical Course Digital Signal Processing:

Successful completion of the practical course is a prerequisite for admission to the written examination. The practical course is considered to be passed successfully if the required simulation programs have been created independently for all topics, yield the desired results and have been handed in on time.

Recommended prerequisites:

thorough understanding of complex calculus and mathematical analysis

Objectives:

After the successful completion of the module the students will be able to

58. represent and manipulate signals in the time and frequency domain,
59. describe and analyse the properties of discrete-time linear systems in the time and frequency domain using discrete-time transforms,
60. design linear discrete-time filters with prescribed properties,
61. evaluate different realisations of discrete-time systems based on canonical structures,
62. understand the impact of finite word-length effects in the realisation of discrete-time systems,
63. determine the limitations and impact of sampling and quantisation on the conversion of analogue to digital signals,
64. apply (fast) Fourier-Transforms to analyse and realise discrete-time signal processing systems,

use MATLAB to analyse and synthesise discrete-time signals and systems.

Content:

65. Discrete-time signals and systems: description in the time-domain, impulse response, convolution, linearity, time-invariance, causality, stability
66. Frequency-domain representation: frequency response, discrete-time Fourier-Transform and its properties
67. Analysis of LTI-systems: the z-Transform and its properties, system transfer function, allpass and minimum phase systems, linear-phase systems
68. Design of digital filters with prescribed properties using windowing techniques, optimisation, the bilinear transform as well as band-transforms

69. Realisation of discrete-time filters: filter structures and signal flow graphs, transposition methods, canonical as well as cascade and parallel architectures

70. Review of the Fourier-Series representation of periodic signals and the Fourier-Transform for continuous signals

71. Sampling and reconstruction of band-limited signals, analogue-to-digital conversion, quantisation

72. Digital multi-rate systems, decimation and interpolation, oversampling analogue-to-digital conversion

The Discrete Fourier-Transform and fast algorithms (FFT) using decimation in time and frequency, applications of the DFT

Literature:

73. HOLTON, Thomas, 2021. *Digital signal processing: principles and applications*. Cambridge, United Kingdom: Cambridge University Press. ISBN 978-1-108-41844-7

74. OPPENHEIM, Alan V. and Ronald W. SCHAFER, 2014. *Discrete-time signal processing*. T. edition. Harlow: Pearson. ISBN 978-1-292-03815-5

75. ANTONIOU, A., 2017. *Digital Filters - Analysis, Design and Signal Processing Applications*. ISBN 0071846034

Embedded Systems

Module abbreviation:	AVE_EmbSys

Curriculum:	**Programmes**
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 25

Responsible for module:	Schiele, Thomas
Lecturers:	Schiele, Thomas
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:	25: Embedded Systems (AVE_EmbSys)
Lecture types:	25-Embedded Systems: SU - lecture (AVE_EmbSys)

Studien- / Prüfungsleistungen:

25-Embedded Systems: TCW-LN mdl. Prüfung (AVE_EmbSys)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

25 Embedded Systems:
- to reflect the architecture and design of microcomputersystems.
76. to explain interaction between hard- and software of embedded systems.
77. to program embeded systems in C and analyze systems on software (debugging) and hardware level (electrical signals).
78. to understand basic prinicples of interaction of embedded systems in vehicle networks.
79. to explain the difference between standard and auto-code generation approaches.
80. apply their theoretical knowledge in practical applications of embedded systems (software development and design of basic electrical circuits).

Content:

25 Embedded Systems:
- architecture of microcomputersystems
81. design of microprocessors and microcontrollers
82. architecture of ECU programs (main loop, interrupt-mode)
83. peripherals of miocrocontrollers (ports, timers, serial communication, analog-digital-converters)
84. standard communication protocols (SPI, I2C, UART, LIN, CAN, Ethernet)
85. visualization and transmission of captured data
86. basics of real-time operating systems (RTOS)
87. programming of microcontrollers using standard programming languages (C, ...)
88. model based software development and auto-code generation unsing Simulink

Literature:

Compulsory:

None

Recommended:

- JIMÉNEZ, Manuel, PALOMERA, Rogelio, COUVERTIER, Isidoro, 2014. *Introduction to Embedded Systems: Using Microcontrollers and the MSP430* [online]. PDF e-Book. ISBN 978-1-4614-3143-5. Available via: https://doi.org/10.1007/978-1-4614-3143-5.

Knowledge Modeling and Machine Learning - Master

Module abbreviation:	AUF_WissMod

Curriculum:	**Programmes**
	International Automotive Engineering (IAE-M) - SPO-Nr.: 9

Responsible for module:	Botsch, Michael
Lecturers:	Botsch, 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:	9: Knowledge Modeling and Machine Learning (AUF_WissMod)
Lecture types:	1: SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

9-Knowledge Modeling and Machine Learning: schrP90 - written exam, 90 minutes (AUF_WissMod)
Additional Explanation:
None

Recommended prerequisites:

Empfohlene Voraussetzung: Grundlagen der statistischen Signalverarbeitung; Grundlagen mathematischer Optimierungsverfahren; eine Programmiersprache

Objectives:

9 Knowledge Modeling and Machine Learning:

Upon successful completion of the course, students will be able to,

- understand and apply the mathematical foundations of statistical signal processing for knowledge modeling and machine learning
89. mathematically describe, implement, and apply classical methods for classification and regression models
90. mathematically describe, implement and apply advanced machine learning methods for classification and regression models
91. understand generative machine learning models
92. use machine learning methods in automated driving applications

Content:

9 Knowledge Modeling and Machine Learning:

- Fundamentals of statistical signal processing (random variables, maximum likelihood and maximum a posteriori parameter estimation, kernel density estimators, bias-variance decomposition, model selection procedures)
93. Bayes classifier and Bayes regression
94. Linear classification and regression models (derivation, implementation, applications)
95. Classification by means of "softmax", k-NN, Nadaraya-Watson regression function (derivation, implementation, applications)
96. Gradient descent method and automatic differentiation in reverse mode (backpropagation)
97. Multi-layer perceptron neural networks (derivation, implementation, applications)
98. Deep Convolutional Neural Networks (derivation, implementation, applications)
99. Radial basis function networks (derivation, implementation, applications)

100.Autoencoder
101.Generative Adverserial Neural Networks
102.Applications in the field of automated driving

Literature:

Compulsory:

None

Recommended:

- BOTSCH, Michael, UTSCHICK, Wolfgang, 2020. *Fahrzeugsicherheit und automatisiertes Fahren: Methoden der Signalverarbeitung und des maschinellen Lernens* [online]. München: Hanser PDF e-Book. ISBN 978-3-446-46804-7. Available via: https://doi.org/10.3139/9783446468047.

103.GOODFELLOW, Ian and others, 2018. *Deep Learning: das umfassende Handbuch : Grundlagen, aktuelle Verfahren und Algorithmen, neue Forschungsansätze*. 1. edition. Frechen: mitp. ISBN 978-3-95845-701-0

104.BISHOP, Christopher M., 2009. *Pattern recognition and machine learning*. 8. edition. New York [u.a.]: Springer. ISBN 0-387-31073-8, 978-1-4939-3843-8

105.BISHOP, Christopher M., BISHOP, Hugh, 2024. *Deep Learning: Foundations and Concepts* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-031-45468-4. Available via: https://doi.org/10.1007/978-3-031-45468-4.

Mathematical Modeling and Simulation - Master

Module abbreviation:	IAE_MMS

Curriculum:	**Programmes**
	International Automotive Engineering (IAE-M) - SPO-Nr.: 1

Responsible for module:	Ebert, Bernd Martin
Lecturers:	Ebert, Bernd 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:	1: Mathematical Modeling and Simulation (IAE_MMS)
Lecture types:	SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

1-Mathematical Modeling and Simulation: schrP90 - written exam, 90 minutes (IAE_MMS)

Additional Explanation:

None

Recommended prerequisites:

Engineering mathematics
Basics of physics: kinematics, mechanics, electricity, thermodynamics
Relationships between describing variables (force, torque, current, ...) of the mechanical and electrical energy domain
Basics of programming
Basics of control engineering

Objectives:

1 Mathematical Modeling and Simulation:

After successfully completing the module, students shall be able to:

- understand the process of system modelling
106. formulate mathematical models of physical systems by means of input/output equations
107. model systems of different energy domains in state space as well as transfer function representation according to unified approaches
108. implement the mathematical model using software tools (e.g. Matlab/Simulink)
109. analyze, validate and interpret the simulation results
110. assess and design a controller for a given plant

Content:

1 Mathematical Modeling and Simulation:

The following topics are covered:

- Modelling of complex mechanical, electrical, thermo-fluidic and interconnected systems
111. Linearity: scaling, superposition, linearization of nonlinear processes
112. Lagrange formalism of second type to derive equations of motion
113. Laplace transforms, transfer functions, and frequency response analysis, behaviour (forced/unforced time and frequency domain responses) of linear time-invariant (LTI) ordinary differential equations.
114. Numerical integration and computer simulation.

115. Design and implementation of controllers

116. Adaptive control by reinforcement learning

117. Tools: Solution of dynamic problems using a digital simulation packages for continuous time/sampled data systems such as MATLAB and Simulink

Literature:

Compulsory:

None

Recommended:

- BROWN, Forbes T., 2007. *Engineering system dynamics: a unified graph-centered approach*. 2. edition. Boca Raton, FL [u.a.]: CRC, Taylor & Francis. ISBN 978-0-8493-9648-9, 0-8493-9648-4

118. KARNOPP, Dean, Donald L. MARGOLIS and Ronald C. ROSENBERG, 2012. *System dynamics: modeling, simulation, and control of mechatronic systems*. 5. edition. Hoboken: Wiley. ISBN 978-0-470-88908-4, 978-1-118-15982-8

119. PALM III, William John, 2021. *System dynamics* . 4. edition. New York, NY: McGraw-Hill. ISBN 978-1-260-57076-2

120. ESHKABILOV, Sulaymon L., 2020. *Practical MATLAB modeling with Simulink: programming and simulating ordinary and partial differential equations* [online]. Berkeley, CA: Apress PDF e-Book. ISBN 978-1-4842-5799-9. Available via: https://doi.org/10.1007/978-1-4842-5799-9.

121. BERTSEKAS, Dimitri P., 2019. *Reinforcement learning and optimal control*. Belmont, Massachusetts: Athena Scientific. ISBN 978-1-886529-39-7

Matlab/Simulink for Automotive System Design - Master

Module abbreviation:	IAE_MSASD

Curriculum:	**Programmes**
	International Automotive Engineering (IAE-M) - SPO-Nr.: 9

Responsible for module:	Arnold, Armin
Lecturers:	Weber, Johannes
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: Matlab/Simulink for Automotive System Design (IAE_MSASD)
Lecture types:	1: SU/PR - Seminaristischer Unterricht/Praktikum

Studien- / Prüfungsleistungen:

9-Matlab/Simulink for Automotive System Design: LN - written exam, 90 minutes (IAE_MSASD)
Additional Explanation:
None

Recommended prerequisites:

Basics of Mathematics for Engineers.

Objectives:

To be determined – if you are interested in this course, please send an e-mail to incomings@thi.de

Content:

To be determined - – if you are interested in this course, please send an e-mail to incomings@thi.de

Literature:

Compulsory:

- COLGREN, Richard Dean, 2007. *Basic MATLAB, Simulink, and Stateflow*. Reston, VA: American Institute of Aeronautics and Astronautics (AIAA). ISBN 978-1-62198-099-5, 978-1-56347-838-3

122. KARRIS, Steven T., 2011. *Introduction to Simulink: with engineering applications*. 3. edition. [Fremont, CA]: Orchard Publications. ISBN 978-1-934404-22-5, 1-934404-22-5

Recommended:

None

Modelling and Simulation

Module abbreviation:	AVE_PractModSim

Curriculum:	**Programmes**
	Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 12 Autonomous Vehicle Engineering (AVE-B) - SPO-Nr.: 12

Responsible for module:	Schiele, Thomas
Lecturers:	Schiele, Thomas
Language of instruction:	English
Credit points / SWS:	7 ECTS / 2 SWS
Workload:	Contact hours: 70 h Self-study: 105 h Total: 175 h
Subjects of the module:	12.2: Practical Course Modelling and Simulation (AVE_PractModSim)
Lecture types:	SU/Ü - seminar class/exercise; Pr - practical course;

Studien- / Prüfungsleistungen:

12.2-Practical Course Modelling and Simulation: LN - participation without/with success (AVE_PractModSim)

Additional Explanation:

12 Practical Course Modelling and Simulation:

During the practical course multiple audits have to be passed. Students have to show in groups their model implementation in Simulink and validation results of several experimental setups.

In sum 6 experimental setups are part of this practical course. After conducting the experiments in the lab the groups have to implement and validate the respective model within 7-14 days and then present their results in an audit. After successfully passing 5 of the 6 audits in time students are allowed to participate in the exam.

Recommended prerequisites:

Mathematics 1 + 2
Electronics, Signals and Measurement
Foundations of Engineering Sciences

Objectives:

12 Practical Course Modelling and Simulation:

After successful participation of the practical course students are able to:

- apply different methods (discussed in the lecture) to derive differential equations of electrical, mechanical and electro-mechanical systems

123. use standard implementation methods in Matlab/Simulink

124. determination and optimization of model parameters based on methods discussed during the lecture

125. validate the implemented models using measurement data generated during lab experiments

Content:

12 Practical Course Modelling and Simulation:

Practical Course:

- Introduction into implementation of dynamic systems in Matlab/Simulink

126. Implementation and parameter identification of a non-linear mechanical system (comparison between mathematical and physical pendulum model)

127. Modeling, implementation, validation and parameter optimization of a linear electrical system (oscillating circuit)

128. Modeling, implementation, validation and parameter optimization of a switched electrical system (DC-DC converter, buck converter)
129. Implementation and validation of electromechanical systems (simple vehicle, DC-motor to lift a mass, crane trolley system)

Literature:
Compulsory:
None
Recommended:
None

Power Supply and Energy Distribution - Master

Module abbreviation:	IAE_PSED

Curriculum:	**Programmes**
	International Automotive Engineering (IAE-M) - SPO-Nr.: 7

Responsible for module:	Pforr, Johannes
Lecturers:	Pforr, Johannes
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:	7.1.2: Power Supply and Energy Distribution (IAE_PSED)
Lecture types:	SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

7.1.2-Power Supply and Energy Distribution: schrP90 - written exam, 90 minutes (IAE_PSED)
Additional Explanation:
None

Recommended prerequisites:

Basic knowledge of electronics

Objectives:

7 Power Supply and Energy Distribution:

After successfully completing the module the students should

- have good knowledge in the field of modern energy distribution systems in cars and of the components used in the automotive energy nets
130. understand why energy management systems are important for the operation of electric energy nets in cars
131. understand the operation principle of power electronic converters for automotive applications
132. understand and to use methods to develop steady-state and dynamic models of power electronic converters for given type of problems
133. analyze and judge the steady-state and dynamic performance of automotive electrical energy nets with power electronic components according to given targets
134. understand the operation principle of modern electric machines for electric and hybrid electric vehicles including the control of the electric machines
135. be able to use steady-state and dynamic models of electric machines in order to analyze the energy flow in automobile electrical energy nets dependent on the operation strategy of the vehicle
136. be able to derive models of given automotive energy nets and the components and to perform simulations for optimization purposes

Content:

7 Power Supply and Energy Distribution:

Introduction, background and design of vehicular electrical energy distribution networks and power electronic systems and devices:

- Power Devices and Converter Topologies
137. 14V / 48V Power Supply and Energy Distribution
138. Generation of electric Power in Vehicles

139. Energy management Systems

140. High Voltage electric Energy Distribution for Hybrid Vehicles

141. Electric motor Drives and motion Control

142. Starter / Generator

143. Simulation

Literature:

Compulsory:

None

Recommended:

- VELTMAN, André, PULLE, Duco W. J., DE DONCKER, Rik W., 2016. *Fundamentals of Electrical Drives* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-319-29409-4, 978-3-319-29408-7. Available via: https://doi.org/10.1007/978-3-319-29409-4.

144. ERICKSON, Robert W. and Dragan MAKSIMOVIĆ, 2004. *Fundamentals of power electronics*. 2. edition. Dordrecht: Kluwer. ISBN 0-7923-7270-0, 978-0-7923-7270-7

145. LEONHARD, Werner, 2001. *Control of electrical drives*. 3. edition. Berlin [u.a.]: Springer. ISBN 3-540-41820-2

146. EHSANI, Mehrdad, Yimin GAO and Ali EMADI, 2010. *Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory, and design*. 2. edition. Boca Raton, FL [u.a.]: CRC Press, Taylor & Francis Group. ISBN 978-1-4200-5400-2, 978-1-4200-5398-2

Power Train - Master

Module abbreviation:	IAE_PT

Curriculum:	**Programmes**
	International Automotive Engineering (IAE-M) - SPO-Nr.: 3

Responsible for module:	Birkner, Christian
Lecturers:	Birkner, 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:	3: Power Train (IAE_PT)
Lecture types:	SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

3-Power Train: schrP90 - written exam, 90 minutes (IAE_PT)

Additional Explanation:

None

Recommended prerequisites:

basic knowledge of physics (Work, Power, Forces, Torques, ...), engineering mathematics (differential and integral calculus), engineering mechanics

Objectives:

3 Power Train:

After successfully completing the module the students

- know details about legal framework conditions for current and future powertrain developments (CO2- and emission legislation, test procedures, test cycles, ...)
147. understand advantages and disadvantages of different drivetrain concepts according to driving performance and energy consumption
148. show detailed knowledge of internal combustion engine design principles and operation strategies
149. are able to explain the operating principles of different gearbox constructions and know advantages and disadvantages of the different concepts
150. have a detailed understanding of hybrid drivetrain architectures and know about the potentials of hybrid drivetrain technology
151. know different energy storage systems for vehicle applications and their advantages and disadvantages
152. are able to set up models and evaluate results from dynamic drivetrain simulations focussing on the impact of operation principles on factors like driving performance and efficiency

Content:

3 Power Train:

- basics of vehicle movement and driving resistances
153. market-specific test procedures for series-production vehicles / certification
154. design principles of internal combustion engines (ICE)
155. advantages/disadvantages of different IC-engine concepts (diesel/gasoline, ...)
156. concepts for fuel consumption reduction in modern IC-engines
157. emission generation in IC-engines / exhaust gas aftertreatment

158. gearbox concepts and start-up elements

159. hybrid and electric drivetrain concepts

160. potentials of electrified drivetrains according to fuel consumption and emission generation

161. energy storage systems for vehicle applications

162. modelling and simulation of different drivetrain concepts

Literature:

Compulsory:

None

Recommended:

- MASHADI, Behrooz, CROLLA, David, 2012. *Vehicle powertrain systems* [online]. Chichester: Wiley PDF e-Book. ISBN 978-0-470-66602-9, 978-1-11-995836-9. Available via: http://onlinelibrary.wiley.com/book/10.1002/9781119958376.

163. TODSEN, Uwe, 2012. *Verbrennungsmotoren* [online]. München: Hanser PDF e-Book. ISBN 978-3-446-42846-1, 978-3-446-41843-1. Available via: http://www.hanser-elibrary.com/action/showBook?doi=10.3139%2F9783446428461.

164. KLEMENT, Werner, 2011. *Fahrzeuggetriebe* [online]. München: Hanser PDF e-Book. ISBN 978-3-446-42807-2, 978-3-446-42600-9. Available via: http://www.hanser-elibrary.com/action/showBook?doi=10.3139%2F9783446428072.

165. HOFMANN, Peter, 2014. *Hybridfahrzeuge: ein alternatives Antriebskonzept für die Zukunft* [online]. Wien [u.a.]: Springer PDF e-Book. ISBN 978-3-7091-1780-4. Available via: http://dx.doi.org/10.1007/978-3-7091-1780-4.

Sensor Networks Technologies and Sensor Data Fusion - Master

Module abbreviation:	AI_SensorNetworks

Curriculum:	**Programmes**
	AI Engineering of Autonomous Systems (AI-M) - SPO-Nr.: 6

Responsible for module:	Kefferpütz, Klaus
Lecturers:	Kefferpütz, Klaus
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: Sensor Networks Technologies and Sensor Data Fusion (AI_SensorNetworks)
Lecture types:	6-Sensor Networks Technologies and Sensor Data Fusion: SU/Ü - lecture with integrated exercises (AI_SensorNetworks)

Studien- / Prüfungsleistungen:

6-Sensor Networks Technologies and Sensor Data Fusion: schrP90 - written exam, 90 minutes (AI_SensorNetworks)

Additional Explanation:

None

Recommended prerequisites:

(digital) signal processing, time-domain and frequency analysis

Objectives:

6 Sensor Networks Technologies and Sensor Data Fusion:

After successfully completing this module the students shall be able to

- understand the fundamental principles of sensor networks.

166. understand communication in sensor networks.
167. apply advanced linear and non-linear digital signal processing to a multitude of sensors.
168. describe and model the most common sensors used in sensor fusion applications.
169. implement basic algorithms for simultaneous localisation and mapping (SLAM).
170. apply sensor fusion to different sensors like cameras, radar, etc..
171. use AI methods like, e.g., federated learning to the field of sensor fusion and sensor networks.

Content:

6 Sensor Networks Technologies and Sensor Data Fusion:

The module comprises the following aspects of sensor networks and sensor data fusion:

- basics and advanced concepts of wireless sensor networks,

172. hardware aspects of sensor nodes,
173. routing in wireless networks,
174. time synchronisation and localisation in wireless networks,
175. data/signal processing in wireless sensor networks,
176. need for multi-sensor data fusion,
177. various approaches to data fusion,
178. representations of data and data fusion architectures,

179. algorithmic approaches to data fusion,
180. applications of wireless sensor networks.

Literature:

Compulsory:

None

Recommended:

- KARL, Holger and Andreas WILLIG, 2007. *Protocols and architectures for wireless sensor networks*. R. edition. Chichester [u.a.]: Wiley. ISBN 978-0-470-51923-3, 0-470-51923-1

181. KOCH, Wolfgang, 2014. *Tracking and Sensor Data Fusion: Methodological Framework and Selected Applications* [online]. Heidelberg: Springer PDF e-Book. ISBN 978-3-642-39271-9, 978-1-306-20127-8. Available via: https://doi.org/10.1007/978-3-642-39271-9.

Sensor Technology and Signal Processing - Master

Module abbreviation:	IAE_ST&SP

Curriculum:	**Programmes**
	Automatisiertes Fahren und Fahrzeugsicherheit (AUF-M) - SPO-Nr.: 11 International Automotive Engineering (IAE-M) - SPO-Nr.: 7

Responsible for module:	Botsch, Michael
Lecturers:	Botsch, Michael
Language of instruction:	German
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h Self-study: 79 h Total: 126 h
Subjects of the module:	11: Sensor Technology and Signal Processing (IAE_ST&SP)
Lecture types:	11-Sensor Technology and Signal Processing: SU/Ü - lecture with integrated exercises (IAE_ST&SP)

Studien- / Prüfungsleistungen:

11-Sensor Technology and Signal Processing: schrP120 - written exam, 120 minutes (IAE_ST&SP)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

11 Sensor Technology and Signal Processing:

After successfully completing the module the students are able to

- describe major trends in the automotive sensor market;

182. categorize automotive sensors with respect to the underlying physical effects;

183. to analyze sensor signals in the time- and frequency-domain;

184. apply statistical signal processing algorithms (e. g., Kalman filter) to automotive sensor data;

185. to evaluate algorithms for sensor data fusion;

186. to design and apply simple machine learning algorithms

187. to implement statistical signal processing algorithms in Matlab.

Content:

11 Sensor Technology and Signal Processing:

- Introduction to Automotive Sensors
  - o   Automotive Sensor Market
  - o   Sensor Technologies
  - o   Sensor Types and Characteristics
  - o   Multi-Modal Sensor Systems

188. Statistical Signal Processing
  - o   Signal Types and Characteristics
  - o   Basics of Statistical Signal Processing
  - o   Pattern Recognition
  - o   Kalman Filter

189. Sensor Data Fusion
    o Data Association
    o Track-To-Track Fusion
190. Analog and Digital Processing of Signals
    o Analog Filters, Amplifiers and A/D Converters
    o Fourier Series and Transform, Laplace- and z-Transform
    o Digital Filters

Literature:

Compulsory:

None

Recommended:

- BAR-SHALOM, Yaakov, LI, Xiao-Rong, KIRUBARAJAN, Thiagalingam, 2001. *Estimation with applications to tracking and navigation* [online]. New York: Wiley PDF e-Book. ISBN 0-471-46521-6, 978-0-471-46521-8. Available via: http://onlinelibrary.wiley.com/book/10.1002/0471221279.

191. REIF, Konrad, 2016. *Sensoren im Kraftfahrzeug* [online]. Wiesbaden: Springer Vieweg PDF e-Book. ISBN 978-3-658-11211-0, 978-3-658-11210-3. Available via: https://doi.org/10.1007/978-3-658-11211-0.

192. BOTSCH, Michael and Wolfgang UTSCHICK, 2020. *Fahrzeugsicherheit und automatisiertes Fahren: Methoden der Signalverarbeitung und des maschinellen Lernens* . ISBN 978-3-446-45326-5

193. , . Current publications from IEEE Symposium on Intelligent Vehicle and from IEEE International Conference on Intelligent Transportation Systems. In: .

Vehicle Crash Mechanics and Biomechanics - **Master**

Module abbreviation:	IAE_VCM

Curriculum:	**Programmes**
	International Automotive Engineering (IAE-M) - SPO-Nr.: 7

Responsible for module:	Brandmeier, Thomas
Lecturers:	Brandmeier, Thomas
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:	7.2.1: Vehicle Crash Mechanics and Biomechanics (IAE_VCM)
Lecture types:	SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

7.2.1-Vehicle Crash Mechanics and Biomechanics: schrP90 - written exam, 90 minutes (IAE_VCM)
Additional Explanation:
None

Recommended prerequisites:

knowledge of basics in mechanics, in electrics/electronics, of communication systems and of vehicle electronics

Objectives:

7 Vehicle Crash Mechanics and Biomechanics:

After successfully completing the module, students know the basic concepts and knowledge in vehicle safety and crash mechanics. The program is structured to cover the important topics related to the vehicle safety: Crash modelling for frontal and lateral collisions and rollovers, finite element analysis, occupant protection strategies, Passive vehicle safety systems (airbag control unit, conventional crash sensors, algorithms, safety actuators) and biomechanics. At the completion of this course, students should be able to understand crash processes, to construct and simulate simple crash models, understand human anatomy and its mechanics during vehicle crash.

Content:

7 Vehicle Crash Mechanics and Biomechanics:

The following topics are covered:

- Basic terms and definitions in vehicle safety
194. Crash Mechanics
195. Crash Modelling, Multibody Modelling, Finite Element Analysis
196. Passive Safety Systems
197. Frontal and lateral collision, Rollover
198. Crash- & Safety-Sensors, Crash detection Algorithms, Use of environmental sensors in Passive Safety
199. Irreversible and reversible Safety Actuators
200. Emergency Medicine
201. Biomechanics

Literature:

Compulsory:

None

Recommended:

- KRAMER, Florian, 1998. *Passive Sicherheit von Kraftfahrzeugen: Grundlagen — Komponenten — Systeme* [online]. Wiesbaden: Vieweg+Teubner Verlag PDF e-Book. ISBN 978-3-322-96883-8, 978-3-322-96884-5. Available via: https://doi.org/10.1007/978-3-322-96883-8.

Course Descriptions

Computer Science

International Office

Winter term 2024/25

As per: 2024-07-30

This program and course description becomes effective on 01.10.2024. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations.

3   Overview

Computer Science and Artificial Intelligence

Fach	SWS	ECTS
Algorithms for AI 2	6	7
Practical Course Algorithms for AI 2	2	0
Data Visualization and Data Analytics	4	5
Introduction to Computer Science I	4	7
Mathematics 1	4	7
Optimization Algorithms	4	5
Probability and Statistics	4	7
Programming 1	6	7
Practical Course Programming 1	2	0
Software Engineering	6	7
Practical Course Software Engineering	2	0
Software Engineering	4	0
Web Technologies	6	7
Practical Course Web Technologies	2	0

Cyber security

Fach	SWS	ECTS
Web-Technologies	4	5

Informatik Bachelor

Fach	SWS	ECTS
Quantum Computing	4	5

Künstliche Intelligenz (Master)

Fach	SWS	ECTS
Entrepreneurship Coaching	4	5

User Experience Design

Fach	SWS	ECTS
eTHIcs_basic	4	5
Machine Learning	4	5

User Experience Design (Master)

Fach	SWS	ECTS
Mobile UX Prototyping	4	5
Project	4	5

4 Module Descriptions

Algorithms for AI 2

Module abbreviation:	CAI_AAI2Pr

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 14 Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 14

Responsible for module:	Windisch, Hans-Michael
Lecturers:	Rößle, Dominik
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:	14.2: Practical Course Algorithms for AI 2 (CAI_AAI2Pr)
Lecture types:	14.1: SU/Ü - lecture with integrated exercises (CAI_AAI1) 14.2: Pr - laboratory (CAI_AAI1Pr)

Studien- / Prüfungsleistungen:

14.2-Practical Course Algorithms for AI 2: LN - participation without/with success (CAI_AAI2Pr)

Additional Explanation:

14 Practical Course Algorithms for AI 2:

Students must successfully complete and submit at least 6 exercise sheets. 9 exercise sheets will be available.

Recommended prerequisites:

None

Objectives:

In this module, students learn to use more advanced algorithms of artificial intelligence and their applications

on structures, unstructured and temporal data. The basic idea and mathematical backgrounds of neural

networks are introduced. Students learn how to train simple neural networks to learn patterns from data

for regression and classification tasks. Further, Deep Learning and its most common architectures are introComputer

Science and Artificial Intelligence (SPO WS 21/22) **Winter term 2024/25**

27

duced, including Convolutions and recurrent connections. Students learn how to effectively train deep learning

networks by choosing optimal hyperparameters and how to avoid overfitting. Thus, methods like Regularization

and Dropout are explained. The goal of this module is further to introduce unsupervised learning

to the students, as well as its application to solve clustering problems. The application of unsupervised learning

in combination with neural networks is illustrated by introducing autoencoders. In addition, it is shown

how to use unsupervised learning methods to reduce the dimensionality of datasets using feature selection

and PCA techniques. After successfully attending this module, students know:

• How to handle structured, unstructured and temporal data.

• What a neural network is and how it can be trained using backpropagation.

• How to use different optimizers for neural networks.

• The most important deep learning architectural layers like convolutions.

• How to effectively train neural networks and to avoid overfitting.

• The basic principles of unsupervised learning and their applications to real world problems.

• How to used features selection and PCA methods to reduce the dimensionality of datasets.

• Different forms of collaborative groups work.

• How to gather knowledge and share it within their learning group.

• How to summarize and present the most important information of a specific topic.

Content:

Learning with structured, unstructured and temporal data

• Basic principles of neural networks

• Backpropagation and different Optimizer

• Convolutional layer

• Recurrent neural networks

• Regularization and Dropout

• Optimizing Hyperparameters

• Unsupervised Learning

o Clustering and its most important algorithms

o Autoencoders

o Dimensionality Reduction

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. New York: Springer. ISBN 978-1-4939-3843-8

• RUSSEL, Stuart and Peter NORVIG, 2021. Artificial intelligence: a modern approach. 4. edition. ISBN 978-1-292-40113-3; 1-292-40113-3

Data Visualization and Data Analytics

Module abbreviation:	CAI_DVsAn

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 15

Responsible for module:	Navarro Bullock, Beate
Lecturers:	Navarro Bullock, Beate
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:	15: Data Visualization and Data Analytics (CAI_DVsAn)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

15-Data Visualization and Data Analytics: schrP90 - written exam, 90 minutes (CAI_DVsAn)
Additional Explanation:
None

Recommended prerequisites:

Basic knowledge of Python

Objectives:

15 Data Visualization and Data Analytics:

At the end of the class, students will

- get an understanding of technologies and software tools to handle fundamental steps in the data analysis pipeline.
- know how to acquire data, for example using web scrapers, APIs or data platforms and how to structure them to most conveniently work with them.
- be able to preprocess and manipulate data.
- apply basic data analysis techniques using Python and real word datasets.
- know common methods to answer basic questions about the data and how to interpret the results.
- have an understanding of data presentation and visualization (reporting, graphical analysis, representation of results).

Content:

15 Data Visualization and Data Analytics:

This course provides a broad overview of principles and algorithms for data analytics and visualization. Specific topics include:

- How to get and structure the data (data collection, usage of web scrapers, APIs etc., data formats, types and structure of data)
- How to process the data (data wrangling and transformation, data reduction, aggregation of data)
- How to analyze data
- How to visualize data (human perception, types of visualizations, visualization design, interactive visualizations, algorithms)
- How to deal with specific types of data (for example time series, text, spatial data)

The lecture is accompanied with (practical) exercises using Python and a selection of visualization tools.

Literature:
Compulsory: None *Recommended:* • MURRAY, Scott, 2017. *Interactive Data Visualization for the Web*. 2. edition. ISBN 978-1491921289 • MUNZNER, Tamara, 2015. *Visualization analysis & design*. Boca Raton [u.a.]: CRC Press, Taylor & Francis Group. ISBN 978-1-4665-0893-4, 978-1-4665-0891-0 • MCKINNEY, Wes, 2017. *Python for Data Analysis*. 2. edition. ISBN 978-1491957660 • VANDERPLAS, Jake, 2017. *Python Data Science Handbook: Essential Tools for Working with Data*. 1. edition. ISBN 978-1491912058

Entrepreneurship Coaching - Master

Module abbreviation:	MVM_EC

Curriculum:	**Programmes**
	Künstliche Intelligenz (Master) (KI-M) - SPO-Nr.: 10

Responsible for module:	Bader, Martin
Lecturers:	Bader, Martin
Language of instruction:	German/English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 47 h
	Self-study: 78 h
	Total: 125 h
Subjects of the module:	10: Entrepreneurship Coaching (MVM_EC)
Lecture types:	SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

10-Entrepreneurship Coaching: LN - practical assignment (MVM_EC)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

After successful participation in the module course, students are able to:

- analyze customer and market needs on basis of advanced design thinking approaches,
- develop and assess a business idea on this basis and apply it to a consistent business model,
- identify and analyze key success factors for implementation,
- prepare and apply implementation on basis of a minimal viable product approach,
- apply the agile business development, prototype testing and lean startup methods and integrate the principles of entrepreneurial thinking in business and leadership,
- prepare participation in a business plan competition at graduate level and to meet the specific challenges,
- successfully integrate the listed competencies with the content of other modules from their degree program and develop new, overarching approaches.

Content:

- Ideation
- Value Proposition Design
- Business Model Canvas
- Business Model Innovation
- Minimal Viable Product & Preto-/Prototyping
- Business Planning

Literature:

Compulsory:

- AULET, Bill, Thomas DEMMIG and Marius URSACHE, 2013. *Disciplined entrepreneurship: 24 steps to a successful startup*. Hoboken, NJ: Wiley. ISBN 978-1-118-69228-8, 978-1-118-72088-2

- BAYSTARTUP GmbH, 2022. Handbuch Businessplan-Erstellung, Der Weg zum erfolgreichen Unternehmen. [online]. https://www.bay-startup.de/startups/handbuch-businessplan-erstellung: BayStartUP GmbH, 18.07.2022 [Accessed on: 18.07.2022]. Available via: https://www.bay-startup.de/fileadmin/Dokumente/Downloads/Handbuch_Businessplan_Erstellung.pdf

Recommended:

- KAWASAKI, Guy, 2015. *The art of the start 2.0: The time-tested, battle-hardened guide for anyone starting anything*. London: Portfolio Penguin. ISBN 978-0-241-18726-5, 978-1-59184-811-0
- 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
- FUEGLISTALLER, Urs, FUST, Alexander, MÜLLER, Christoph, MÜLLER, Susan, ZELLWEGER, Thomas, 2019. *Entrepreneurship: Modelle – Umsetzung – Perspektiven : Mit Fallbeispielen aus Deutschland, Österreich und der Schweiz* [online]. Wiesbaden: Springer Gabler PDF e-Book. ISBN 978-3-658-26800-8. Available via: https://doi.org/10.1007/978-3-658-26800-8.
- GASSMANN, Oliver, Karolin FRANKENBERGER and Michaela CSIK, 2017. *Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler Business Model Navigator*. 2. edition. München: Hanser. ISBN 978-3446451759
- GASSMANN, Oliver, Karolin FRANKENBERGER and Michaela CHOUDURY, 2020. *Business Model Navigator: The Strategies Behind the Most Successful Companies*. 2. edition. Harlow: Pearson. ISBN 978-1292327129
- OSTERWALDER, Alexander and Yves PIGNEUR, 2010. *Business Model Generation: Ein Handbuch für Visionäre, Spielveränderer und Herausforderer*. ISBN 978-3-593-39474-9
- OSTERWALDER, Alexander and Yves PIGNEUR, 2014. *Value Proposition Design: How to Create Products and Services Customers Want*. ISBN 978-1118968055

eTHIcs_basic

Module abbreviation:	IB_ETHICS_en

Curriculum:	**Programmes**
	User Experience Design (UXD-B) - SPO-Nr.: 28

Responsible for module:	Stahl, Ingrid
Lecturers:	Richter, Florian
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: eTHIcs_basic (IB_ETHICS_en)
Lecture types:	28-eTHIcs_basic: SU/Ü - lecture with integrated exercises (IB_ETHICS_en)

Studien- / Prüfungsleistungen:

28-eTHIcs_basic: (IB_ETHICS_en)

Additional Explanation:

28 eTHIcs_basic:

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).

Recommended prerequisites:

None

Objectives:

28 eTHIcs_basic:

On successful completion of the course, students will be able to

- 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:

28 eTHIcs_basic:

The ethics of technology deals with moral questions that concern the usage of technologies. It raises fundamental questions about our relationship with technologies.

- 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?

Certain technologies may raise more specific questions.

- What are the challenges of hybrid traffic in which manual and automized 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?

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.

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:

Compulsory:

None

Recommended:

- 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

Introduction to Computer Science 1

Module abbreviation:	CAI_CS1

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 2

Responsible for module:	Windisch, Hans-Michael
Lecturers:	Sofra, Nikoletta
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:	2.1: Introduction to Computer Science 1 (CAI_CS1)
Lecture types:	2.1: SU - integrated lecture 2.2: Ü - exercises

Studien- / Prüfungsleistungen:

2.1-Introduction to Computer Science 1: schrP90 - written exam, 90 minutes (CAI_CS1)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

The objective of this course is to develop a basic understanding of how algorithms (sequences of machine-executable computational steps) are executed on computers (program-controlled information processing systems).

After successful participation, the students are able

- to explain the concept of an algorithm.
- to assess whether a problem is calculable, i.e. an algorithm can be formulated to solve it.
- to estimate the complexity of a given algorithm.
- to understand how an algorithm is processed on a computer.
- to describe the structure of a universal computer and how it works.
- to classify various advanced computer architecture concepts.

Content:

Algorithms
- Concept of algorithms, properties, forms of representation
- Computability
  - Turing computability
  - LOOP, WHILE, GOTO computability
  - Church-Turing thesis
- Decidability
  - Halting problem
  - RICE's theorem
- Complexity
  - O notation

- o Complexity classes P and NP

Computer architecture

- Binary representation of information
  - o Natural, negative, fractional numbers
  - o Machine instructions and programs
- Digital circuits
  - o Logical elements, combinational circuits
  - o Storage elements, registers, counters, sequential circuits
- Von Neumann architecture
- Advanced concepts in today's computer architectures
  - o Caching
  - o Multi-core architectures
  - o Instruction pipelining
  - o Graphics processing units

Literature:

- PATTERSON, David A. and John L. HENNESSY, 2021. *Computer organization and design: the hardware software interface*. S. edition. Cambridge, MA: Morgan Kaufmann. ISBN 978-0-12-820109-1
- STALLINGS, William, 2016. *Computer organization and architecture: designing for performance*. 10. edition. Hoboken, NJ [u.a.]: Pearson Education.
- AHO, Alfred V., John E. HOPCROFT and Jeffrey D. ULLMAN, 1995. *The design and analysis of computer algorithms*. [. edition. Reading, Mass. [u.a.]: Addison-Wesley. ISBN 0-201-00029-6
- SIPSER, Michael, . *Introduction to the Theory of Computation*.

Machine Learning

Module abbreviation:	IB_ML	
Curriculum:	**Programmes**	
	User Experience Design (UXD-B) - SPO-Nr.: 28	

Responsible for module:	Regensburger, Franz	
Lecturers:	Mohamady, Samira	
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: Machine Learning (IB_ML)	
Lecture types:	28-Machine Learning: SU - lecture (IB_ML)	

Studien- / Prüfungsleistungen:

28-Machine Learning: LN - written exam, 90 minutes (IB_ML)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

28 Machine Learning:

In this learning module, algorithms and their applications are illustrated by real world examples. After successfully attending this module, students know and understand the basic principles of learning systems and their applications to real world problems. They know

- the different methods how to learn from data
- the mathematical basis and the most important algorithms to train machine learning models on their own
- the different building blocks of deep neural networks and how to apply them to solve real world problems, e.g. for computer vision or natural language processing.
- how to evaluate and validate machine learning models
- the basic pitfalls and problems when training models and how to solve them efficiently

Content:

28 Machine Learning:

- Basic concepts of Machine Learning
- Preprocessing
- Supervised Learning
  - o Regression
  - o Classification
- Unsupervised Learning
- Reinforcement Learning
- Evaluation and Validation
- Neural Networks
- Deep Learning

- Frameworks and Tools
- Practical applications of modern machine learning algorithms

Literature:

Compulsory:

None

Recommended:

None

Mathematics 1

Module abbreviation:	CAI_Math1

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 3

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:	3.1: Mathematics 1 (CAI_Math1)
Lecture types:	3.1: SU - integrated lecture 3.2: Ü - exercises

Studien- / Prüfungsleistungen:

3.1-Mathematics 1: schrP90 - written exam, 90 minutes (CAI_Math1)

Additional Explanation:

3 Mathematics 1:

No requirements. A solid understanding of school mathematics is beneficial.

Recommended prerequisites:

high school level algebra and geometry

Objectives:

3 Mathematics 1:

After successful completion of this course, the student is able to

- state the basic facts in logic and apply results to appropriate examples.
- understand the structure of proofs and construct proofs in computer-science related problems (for example, mathematical induction).
- represent complex numbers in various forms in order to solve equations and inequalities.
- analyze limit processes to sequences (explicit and recursively defined).
- state, apply, and interpret formulas and theorems in differential calculus.
- develop Taylor polynomials and approximate the error using Lagrange remainders.
- develop infinite series and determine their radii and intervals of convergence.
- state and apply the definition of Riemann integrals, the fundamental theorem of calculus and the mean value theorem for integrals. Apply the basic integration techniques such as substitution and partial integration.

Content:

3 Mathematics 1:

- Foundations of logic
- Methods of proof, especially mathematical induction
- Relations and functions
- Sequences and series, convergence
- Continuity
- Differentiation

• Integration

Literature:

Compulsory:

None

Recommended:

- FRIEDMAN, Menahem, KANDEL, Abraham, 2011. *Calculus light* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-3-642-17848-1, 978-3-642-17847-4. Available via: https://doi.org/10.1007/978-3-642-17848-1.

- RAHMANI-ANDEBILI, Mehdi, 2021. *Calculus: Practice Problems, Methods, and Solutions* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-030-64980-7. Available via: 10.1007/978-3-030-64980-7 .

- ARANGALA, Crista, 2023. *Linear Algebra with Machine Learning and Data*. 1. edition. Milton: CRC Press LLC. ISBN 978-1-00-085620-0

Mobile UX Prototyping - Master

Module abbreviation:	UXDM_MUXP

Curriculum:	**Programmes**
	User Experience Design (Master) (UXD-M) - SPO-Nr.: 6

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:	6: Mobile UX Prototyping (UXDM_MUXP)
Lecture types:	6-Mobile UX Prototyping: SU/Ü - lecture with integrated exercises (UXDM_MUXP)

Studien- / Prüfungsleistungen:

6-Mobile UX Prototyping: seminar paper and presentation (UXDM_MUXP)

Additional Explanation:

6 Mobile UX Prototyping:

The seminar paper has a length of approx. 5,000 words (minimum 4,500, maximum 5,500). The duration of the final presentation is set at 30 minutes (it is recommended to create a slide deck with approx. 15-20 slides)

Recommended prerequisites:

There are no prerequisites or corequisites for this class. However, a basic understanding of the practical application of the human-centered design process, experience in prototyping software applications and in the evaluation of interactive systems, and expertise in conducting heuristic evaluations and/or usability tests would be beneficial.

Objectives:

6 Mobile UX Prototyping:

After active participation in the course, students

- ...have acquired in-depth knowledge of the mobile market and know what characterizes competitive apps
- ...have acquired the competence to develop mockups and prototypes for mobile applications themselves
- … can analyze and interpret the mobile user experience of existing applications and derive appropriate solutions
- …have gained a thorough understanding of the concept of push notification and can apply it to create new app user experiences
- …have gained the knowledge to reliably and successfully deal with new opportunities and challenges in user experience
- …have acquired the competence to implement the "Offline First" paradigm in their developments

Self- and social competences:

Upon completion of the module, students

- …have acquired the competence to present their usability studies on mobile apps in a focused presentation and to moderate a sound discussion with the audience
- …can communicate professionally at an adequate level of abstraction using appropriate forms of media
- ...have gained extensive experience in intercultural cooperation

•	...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 for it

Content:

6 Mobile UX Prototyping:
- "How to build a billion-dollar app"
- The mobile market
- Technologies for apps
- Navigation, menus and patterns
- Search strategies and auto-completion
- Types of forms incl. authentication/passwords
- Tables and tabular data
- Tools, toolbars, and screen control
- System status, affordance, and feedback/error messages
- Help systems, User guides/FAQs, contextual help
- Tutorials and invitations: Engage the user
- Social patterns and gamification
- Visualization: Charts, dashboards, tables
- "Anti-patterns": Metaphors and mental model (mismatch)

Literature:

Compulsory:
- LIEBEL, Christian, 2019. *Progressive Web Apps: das Praxisbuch*. 1. edition. Bonn: Rheinwerk Verlag. ISBN 978-3-8362-6494-5
- NEIL, Theresa, 2014. *Mobile design pattern gallery: UI patterns for smartphone apps*. 2. edition. Sebastopol, CA: O'Reily.
- ATER, Tal, 2017. *Building Progressive Web Apps: bringing the power of native to the browser*. F. edition. Bejing; Boston; Farnham: O'Reily. ISBN 978-1-4919-6162-9
- JOOSR, 2016. *A Joosr guide to How to build a billion dollar app by George Berkowski*. ISBN 978-1-78567-516-4
- SEMLER, Jan and Kira TSCHIERSCHKE, 2019. *App-Design*. 2. edition. Bonn: Rheinwerk Verlag. ISBN 978-3-8362-7052-6
- STAUFFER, Matt, April 2019. *Laravel: up & running: a framework for building modern PHP apps*. S. edition. Sebastopol, CA: O'Reilly Media. ISBN 978-1-492-04121-4, 1492041211
- TIDWELL, Jenifer, Charles BREWER and Aynne VALENCIA, 2020. *Designing interfaces: patterns for effective interaction design*. T. edition. Beijing: O'Reilly. ISBN 978-1-492-05193-0, 978-1-492-05191-6

Recommended:
None

Optimization Algorithms

Module abbreviation:	CAI_OpAlg

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 13

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:	13: Optimization Algorithms (CAI_OpAlg)
Lecture types:	13-Optimization Algorithms: SU/Ü - lecture with integrated exercises (CAI_OpAlg)

Studien- / Prüfungsleistungen:

13-Optimization Algorithms: schrP90 - written exam, 90 minutes (CAI_OpAlg)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

13 Optimization Algorithms:

After successfully completing the module the students ...

- Category Knowledge:
  ... have knowledge of important notations, concepts, and methods of optimization.
- Category Comprehension:
  ... understand the benefit of optimization in the treatment of application problems and as foundation of machine learning and artificial intelligence.
- ... can explain important notations and concepts using examples and thereby understand the essential methods.
- Category Application:
  ... independently solve typical optimization tasks.
- ... recognize optimization problems that arise when working on application problems and solve them with suitable methods.
- ... familiarize themselves with new optimization methods if necessary.
- Category Analysis:
  ... critically question optimization methods with regard to their applicability for existing problems and check the results for plausibility.
- Category Evaluation:
  ... interpret and assess the results in the application context.

After successful participation in the Optimization module, the students will be able to meet the mathematical requirements of the advanced subjects and are able to familiarize themselves with further optimization methods in the area of machine learning and artificial intelligence.

Content:

13 Optimization Algorithms:

Overview and foundations:
- Introduction and overview to optimization
- General optimization problem
- Classification of optimization problems and methods
- Topological foundations of n-dimensional real sets
- Functions with several variables and continuity
- Convexity of sets and functions

Analytical optimization:
- Optimization with one variable
- Partial and directional derivatives
- Gradients, Hessian matrix and definiteness-criteria of matrices
- Optimization without constraints I
- Optimization without constraints II
- Optimization with equality-constraints

Numerical optimization:
- Introduction to numerical methods and numerical scalar optimization
- Numerical vector optimization
- Gradient methods I
- Gradient methods II
- Nelder-Mead method

Linear optimization:
- Linear optimization
- Simplex method
- Integer and binary optimization
- Tools for linear optimization I
- Tools for linear optimization II

Graph Optimization
- Graph Theory
- Trees and tree search
- Shortest Paths and Minimal Spanning Trees

Literature:

Compulsory:

None

Recommended:

- DEISENROTH, Marc Peter, A. Aldo FAISAL and Cheng Soon ONG, 2020. *Mathematics for machine learning*. Cambridge: Cambridge University Press. ISBN 978-1-108-45514-5
- AGGARWAL, Charu C., 2020. *Linear algebra and optimization for machine learning: a textbook* [online]. Cham: Springer PDF e-Book. ISBN 978-3-030-40344-7. Available via: https://doi.org/10.1007/978-3-030-40344-7.
- DIESTEL, Reinhard, 2017. *Graph theory*. F. edition. Berlin: Springer. ISBN 978-3-662-53621-6, 978-3-662-57149-1

Probability and Statistics

Module abbreviation:	CAI_PrSt

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 4

Responsible for module:	Krüger, Max
Lecturers:	Krüger, Max
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:	4.1: Probability and Statistics (CAI_PrSt)
Lecture types:	4.1: SU - lecture 4.2: Ü - exercises

Studien- / Prüfungsleistungen:

4.1-Probability and Statistics: schrP90 - written exam, 90 minutes (CAI_PrSt)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

4 Probability and Statistics:

After successfully completing the module the students ...

- Category Knowledge:
  ... have knowledge of important concepts, processes and applications of applied statistics.
- Category Comprehension:
  ... understand the importance of statistics in the description and treatment of application problems.
- ... can explain important statistical procedures using examples and thereby understand the essential procedures.
- Category Application:
  ... independently solve typical statistical tasks.
- ... recognize statistical problems that arise when working on application problems and solve them with suitable methods.
- ... familiarize themselves with new statistical methods if necessary.
- Category Analysis:
  ... critically question statistical methods with regard to their applicability for existing problems and check the results for plausibility.
- Category Evaluation:
  ... interpret and assess the results in the application context.

After successful participation in the Probability and Statistics module, the students will be able to meet the stochastic requirements of the advanced subjects and are able to familiarize themselves with further procedures.

Content:

4 Probability and Statistics:

Descriptive Statistics:
- attributes, scales, and random samples
- tabular and graphical representations
- location and variability measures
- bivariate covariance and correlation
- linear and nonlinear regression

Probability Theory:
- random events and probability
- probability calculus and combinatorics
- Bayesian probability
- discrete random variables
- continuous random variables
- discrete probability distributions
- continuous probability distributions
- quantiles of probability distributions

Inferential Statistics:
- limit theorems and parameter estimation
- foundations of confidence intervals
- confidence-interval estimators
- foundations of test theory
- construction of parameter tests
- parameter tests
- independence and goodness-of-fit tests

Literature:

Compulsory:

None

Recommended:

- NAVIDI, William, 2020. *Statistics for engineers and scientists*. f. edition. New York, NY: McGraw-Hill Education. ISBN 978-1-260-54788-7, 1-260-54788-4
- HAGHIGHI, Aliakbar Montazer and Indika Rathnathungalage WICKRAMASINGHE, 2021. *Probability, statistics, and stochastic processes for engineers and scientists*. F. edition. Boca Raton, FL: CRC Press. ISBN 978-0-8153-7590-6
- WEINBERG, Sharon Lawner, Daphna HAREL and Sarah Knapp ABRAMOWITZ, 2021. *Statistics using R: an integrative approach*. Cambridge: Cambridge University Press. ISBN 978-1-108-71914-8

Programming 1

Module abbreviation:	CAI_Prog1	

Curriculum:	**Programmes**	
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 1	

Responsible for module:	Lausser, Ludwig Maximilian
Lecturers:	Lausser, Ludwig Maximilian (CAI_Prog1) Lausser, Ludwig Maximilian (CAI_Prog1Pr)
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:	1.1: Programming 1 (CAI_Prog1) 1.2: Practical Course Programming 1 (CAI_Prog1Pr)
Lecture types:	1.1: SU/Ü - integrated lecture and exercises 1.2: Pr - practical course

Studien- / Prüfungsleistungen:

1.1-Programming 1: schrP90 - written exam, 90 minutes (CAI_Prog1)

1.2-Practical Course Programming 1: LN - participation without/with success (CAI_Prog1Pr)

Additional Explanation:

1 Practical Course Programming 1 (CAI_Prog1Pr):

Students must successfully complete and submit at least 7 exercise sheets

Recommended prerequisites:

None

Objectives:

1 Programming 1:

The module is designed to teach students to program in Python in a practical manner using industry standard methods, tools and technologies. It not only teaches students the Python programming language but also improves their algorithmic thinking and problem-solving capabilities so that they can write code that actually works and produces the desired functional results.

After completion of the module the students will be able to

- understand the programming basics (operations, control structures, data types, etc.).
- readily use the Python programming language.
- apply various data types and control structure.
- understand class inheritance and polymorphism.
- understand the object-oriented program design and development.
- understand and begin to implement code.

Content:

1 Programming 1:

The following topics are covered:

- Introduction: foundations of algorithms and information processing
- Information representation: Data Types, variables and basic data structures

- Control structures: conditional execution, loops, lists and list processing
- Procedural abstraction: functions modules and packages
- Objects and classes
- Advanced topics: exceptions, events and event-driven programming

Literature:

Compulsory:

- LAMBERT, Kenneth A. and Martin OSBORNE, 2019. *Fundamentals of Python: first programs*. S. edition. Boston, MA: Cengage. ISBN 1-337-56009-X, 978-1-337-56009-2

Recommended:

None

Compulsory:

None

Recommended:

None

Project - Master

Module abbreviation:	UXDM_PR

Curriculum:	**Programmes**
	User Experience Design (Master) (UXD-M) - SPO-Nr.: 10

Responsible for module:	Riener, Andreas
Lecturers:	Nestler, Simon; 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:	10: Project (UXDM_PR)
Lecture types:	10-Project: Prj - project (UXDM_PR)

Studien- / Prüfungsleistungen:

10-Project: project report (min. 5 pages excluding tables and graphs, font size 10-12 pt.) and a presentation (10-15 minutes) (UXDM_PR)

Additional Explanation:

None

Recommended prerequisites:

There are no prerequisites or corequisites for this class. However, depending on the role, a participant wants to play in the project, appropriate prior knowledge (i.e., basic knowledge of agile project management and PM tools, programming experience, design skills, knowledge of user research, data analysis, and visualization, or statistics) would be beneficial.

Objectives:

After active participation in the course, students
- ...have developed a broad understanding of the interdisciplinary context
- ...can apply management techniques to support the development and distribution of systems and products throughout their life cycle
- ...know how to effectively cooperate in interdisciplinary teams
- ...have acquired knowledge about how to organize team processes
- ...know how to apply creativity techniques and moderate groups
- ...have acquired the ability to evaluate project milestones and argue the decision to move forward in the process
- ...know about the benefits of the iterative development process and can apply them in the product development process
- ... can evaluate and improve the usability of products and to differentiate usability from user experience
- ...have acquired the ability to recognize and evaluate the quality of design

Self- and social competences:

Upon completion of the module, students
- ...have improved on methodological skills and social competence
- ...can communicate professionally at an adequate level of abstraction using appropriate forms of media
- ... can present research results to different audiences, either as oral presentation or written report
- ...have acquired the competence to work successfully in (global) teams

Based on the role taken individually, learning outcomes may differ.

Content:

Each semester, several projects with different thematic alignments are offered. Depending on the project, the focus and thus also the contents differ.

- Introduction to the project/problem statement
- Related work analysis/state-of-the-art research
- Brainstorming/Ideation processes
- User research
- Implementation of software/hardware prototypes
- Study design and execution of user studies
- Data analysis, results presentation and interpretation
- Derivation of recommendations
- Preparing of presentations, teaser video, project report

The project module is carried out in a team of about 12 students and, in many cases, is offered by external companies or the university's research center FORTEC. Alternatively, lecturers/PhD students also specifically present project topics that are to be processed as part of their teaching or research activities.

The project management and organization is the responsibility of the students. The instructor acts only as a coach and/or client (product owner). Classic methods or agile methods such as Scrum or Kanban can be used as project management methods. The decision on which method is used is up to the project team, as are the tools used for project management.

At the beginning of the project, the lecturer communicates his expectations regarding the dates, form, and proof of the individual achievements to be provided by all students. The project team agrees with the lecturer on the forms of communication and documentation to be adhered to by all project participants (students, lecturer, client) during the project period.

A description of the specific projects (this module is only offered in the winter term) will be published in Moodle: https://moodle.thi.de/course/view.php?id=6470#section-8.

Literature:

Compulsory:

- 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 978-1-78728-020-5

Recommended:

- LAYTON, Mark C., Steven J. OSTERMILLER and Dean J. KYNASTON, 2020. *Agile Project Management for Dummies*. 3. edition. Newark: John Wiley & Sons, Incorporated. ISBN 978-1-119-67706-2
- 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

Quantum Computing

Module abbreviation:	IC_QC_eng

Curriculum:	**Programmes**
	Informatik Bachelor (INF-B) - SPO-Nr.: 25

Responsible for module:	Margull, Ulrich
Lecturers:	Margull, Ulrich
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:	25: Quantum Computing (IC_QC_eng)
Lecture types:	25-Quantum Computing: SU/Ü - lecture with integrated exercises (IC_QC_eng)

Studien- / Prüfungsleistungen:

25-Quantum Computing: LN - written exam, 90 minutes (IC_QC_eng)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

25 Quantum Computing:

On completion of the course a student

- understands the fundamental difference between classical computing and quantum computing.
- understands quantum based circuits and is able to design them.
- is able to solve problems using a quantum computer.
- understands the principles of quantum cryptographic protocols.
- understands the potential of quantum applications and is able to rank future trends in quantum computing and quantum hardware.

Content:

25 Quantum Computing:

- Principles of quantum computing: qubit, quantum register, quantum circuit
- Programming a quantum computer (with practical exercises, using IBM Qiskit)
- Algorithms of quantum computing
- Quantum based communication (quantum internet)
- Quantum cryptograpic protocols
- Quantum hardware and error correction
- Current applications of quantum computing
- Mathematical and physical basics: complex numbers, matrices, vector spaces, basic quantum mechanic effects, like superposition, entanglement

Literature:

Compulsory:

None

Recommended:

- NIELSEN, Michael A. and Isaac L. CHUANG, 2010. *Quantum computation and quantum information*. 10. edition. Cambridge: Cambridge University Press. ISBN 978-1-107-00217-3, 978-0-511-99400-5
- YANOFSKY, Noson S. and Mirco A. MANNUCCI, 2008. *Quantum computing for computer scientists*. 1. edition. Cambridge: Cambridge Univ. Press. ISBN 978-0-521-87996-5

Software Engineering

Module abbreviation:	CAI_SwEng

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 11

Responsible for module:	Djanatliev, Anatoli
Lecturers:	Djanatliev, Anatoli (CAI_SwEng) Djanatliev, Anatoli (CAI_SwEngPr)
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:	11.1: Software Engineering (CAI_SwEng) 11.2: Practical Course Software Engineering (CAI_SwEngPr)
Lecture types:	11.1 SU/Ü - seminar-based teaching/exercise 11.2: Pr - practical course

Studien- / Prüfungsleistungen:

11.1-Software Engineering: schrP90 - written exam, 90 minutes (CAI_SwEng)
11.2-Practical Course Software Engineering: LN - participation without/with success (CAI_SwEngPr)

Additional Explanation:

11 Practical Course Software Engineering (CAI_SwEngPr):

To successfully pass the course, continuous participation and individual (re)processing of tasks on the computer are mandatory - especially if no or only little previous experience in the field of software development is available. In the context of the practical course, various tasks that deal with different topics of the lecture are to be worked on independently. For this purpose, the students have to work on up to 10 task sheets. The solutions are to be handed in individually or in small groups within a given time schedule (usually every 1 - 2 weeks), whereby questions about the solution concept created are to be answered. The schedule is aligned with the progress of the lecture. Only if 80% of the tests are acquired in time, the performance record (predicate "passed with success") is considered to be achieved.

Recommended prerequisites:

Basics   of   programming
Basics of Computer Science

Objectives:

11 Software Engineering:

After participating in this module students are able to...

* explain the foundations of software engineering;
* analyse and structure software requirements;
* formally describe software components and interfaces;
* develop, test and document simple software components in a high-level programming language;
* use development tools (software engineering tool-chain) effectively;
* cooperate in and across teams during the development of software applications.

11 Practical Course Software Engineering (CAI_SwEngPr):

After attending the practical course

- the students have their own practical experience in applying software engineering methods.
- the students have practical experiences in the analysis, planning and conversion of software systems.
- the listeners can document requirements to a software product in a structured way.
- the students are able to describe software system with the help of UML diagrams.
- are the listeners able to design and document the software architecture.
- are the students in the position to convert the architecture of a software.
- students are able to specify test cases and document test executions.

Content:

11 Software Engineering:
- Foundations of software engineering
- Systematic analysis of software requirements
- Modelling of requirements and components of a software product
- Specification and documentation of software component interfaces
- Development of software modules in teams including test and documentation
- Consistent use of software engineering tools (IDE, sourcecode-, build-, artifact-management)

11 Practical Course Software Engineering (CAI_SwEngPr):

Requirements engineering
- Stakeholderanalyses and System context
- Literal documentation of requirements
- Use cases modelling
- Class diagrams
- State diagrams

Software architecture & design
- Derive a component architecture with Entity-Boundary-Controller and Sequence diagrams
- Component diagrams

Implementation
- Implementation of a component architecture

Testing
- Blackboxtesting
- Whiteboxtesting

Literature:

Compulsory:

None

Recommended:
- THOMAS, David and Andrew HUNT, 2020. *The pragmatic programmer: your journey to mastery*. 20. edition. Boston: Addison-Wesley. ISBN 978-0-13-595705-9, 0-13-595705-2
- MILES, Russ and Kim HAMILTON, 2006. *Learning UML 2.0: [a pragmatic introduction to UML]*. 1. edition. Sebastopol, CA: O'Reilly & Associates. ISBN 0-596-00982-8
- GAMMA, Erich and others, 1994. *Design Patterns - Elements of Reusable Object-Oriented Software*. ISBN 0-201-63361-2

Compulsory:

None

Recommended:

None

Web Technologies

Module abbreviation:	CSI_WEB

Curriculum:	**Programmes**
	Cybersicherheit (CSI-B) - SPO-Nr.: 16

Responsible for module:	Eggendorfer, Tobias
Lecturers:	Eggendorfer, 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:	16: Web Technologies (CSI_WEB)
Lecture types:	16-Web Technologies: SU/Ü - lecture with integrated exercises (CSI_WEB)

Studien- / Prüfungsleistungen:

16-Web Technologies: schrP90 - written exam, 90 minutes (CSI_WEB)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

This lecture provides an introduction to commonly used technologies in web applications and web services. Students will be able to write their own web applications and web services. They will be able to analyze web applications

Content:

1. WWW Fundamentals (design principles, protocols like HTTP(S), DNS)
1. Client-side technologies (lSGML, XML, HTML, XHTML, HTML5, CSS, JavaScript, DOM,...)
2. Server-side technologies (session management, PHP, AJAX, NodeJS, APIs, Cookies...)
3. Design of web applications and web services (REST, MVC, ...)
4. Legal issues
5. SEO

Literature:

Compulsory:

None

Recommended:

None

Web Technologies

Module abbreviation:	CAI_WebT

Curriculum:	**Programmes**
	Computer Science and Artificial Intelligence (CAI-B) - SPO-Nr.: 12

Responsible for module:	Djanatliev, Anatoli
Lecturers:	Djanatliev, Anatoli (CAI_WebT) Djanatliev, Anatoli (CAI_WebTPr)
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:	12.1: Web Technologies (CAI_WebT) 12.2: Practical Course Web Technologies (CAI_WebTPr)
Lecture types:	12.1: SU/Ü - lecture with integrated exercises 12.2: Pr - laboratory

Studien- / Prüfungsleistungen:

12.1-Web Technologies: schrP90 - written exam, 90 minutes (CAI_WebT)
12.2-Practical Course Web Technologies: LN - participation without/with success (CAI_WebTPr)

Additional Explanation:

12 Web Technologies:

A prerequisite for participation in the written examination is a successfully completed practical course (see SPO No. 12.2).

12 Practical Course Web Technologies (CAI_WebTPr):

Five test certificates must be acquired in the practical course. The lecturer will award one testate each upon successful completion of the assignment. In total, at least 80% of the testates must be completed, which cover essential topics of the lecture.

Recommended prerequisites:

Programming concepts like Serialization and Processing of Markup Languages in Python

Objectives:

After attending the course, students
- 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.

12 Practical Course Web Technologies (CAI_WebTPr):

After the practical course students know the basic structure of a web applications, and how a web browser interacts with a web server.

Content:

Core technologies of the Web:
- 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

Subsidiary topics:
- Web Services (REST), Web Security and Privacy Tools
- Responsive Website Design

12 Practical Course Web Technologies (CAI_WebTPr):

Programming tasks
- introducing to the Hypertext Transfer Protocol (HTTP) request/response cycle and obtaining an understanding of Hypertext Markup Language (HTML), as well as the overall structure of a Django application
- exploring the Model-View-Controller (MVC) pattern for web applications and how it relates to Django

Literature:

Compulsory:

None

Recommended:
- FELKE-MORRIS, Terry Ann, 2017. *Web development and design foundations with HTML5*. 8. edition. Boston: Pearson. ISBN 978-1-292-16408-3
- GAGLIARDI, Valentino, 2021. *Decoupled Django: Understand and Build Decoupled Django Architectures for JavaScript Front-ends* [online]. Berkeley, CA: Apress PDF e-Book. ISBN 978-1-4842-7144-5. Available via: https://doi.org/10.1007/978-1-4842-7144-5.
- GUTIERREZ, Carlos, FERNÁNDEZ-MEDINA, Eduardo, PIATTINI, Mario, 2010. *Web services security development and architecture: theoretical and practical issues* [online]. Hershey ; New York: Information Science Reference PDF e-Book. ISBN 978-1-60566-951-9. Available via: http://services.igi-global.com/resolvedoi/resolve.aspx?doi=10.4018/978-1-60566-950-2.
- MANVI, Sunilkumar, SHYAM, Gopal Krishna, 2021. *Cloud computing: concepts and technologies* [online]. Boca Raton ; London ; New York: CRC Press, Taylor &Francis Group PDF e-Book. ISBN 978-1-00-309367-1. Available via: https://doi.org/10.1201/9781003093671.

Course Descriptions

Business School

This program and course description becomes effective on 01.10.2024. 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)

Fach	SWS	ECTS
International Accounting and Auditing	4	6
Marketing	4	5
Methods & Instruments of Strategic Controlling	4	6
Product ideation	2	3
Strategic Management	6	8
Successful Management in a Global World	2	3
Successful Negotiations in a Global World	2	3
Supply Chain Management (BW_OM4)	4	6
Sustainability and CSR Management (BW_HR4)	4	6
Sustainability Reporting across Europe	2	3

Global Economics and Business Management (Bachelor)

Fach	SWS	ECTS
Corporate Finance	4	5
Cost Accounting and Cost Management	4	5
HR Management, Organization and Leadership	4	5
Marketing and Sales	4	5

International Management (Bachelor)

Fach	SWS	ECTS
Corporate Finance	4	5
Current Issues in Economics	4	6
Digital Transformation & Business Models	4	5
Global Supply Chain Management	4	5
International Business Simulation	3	5
International Project	4	5

Life Science Management (Bachelor)

Fach	SWS	ECTS
Digital Biotechnology and Bio Revolution	4	6
Portfolio Management in Research and Development	4	6
Projektmanagement	4	5

Entrepreneurship and Digital Business (Master)

Fach	SWS	ECTS
Entrepreneurial Methods	4	5
Lean Analytics	4	5

Financial Management und Controlling (Master)

Fach	SWS	ECTS
Intercultural Business and Business in China	4	5

Global Business (Master)

Fach	SWS	ECTS
Global Business and Economics 1	4	5
Global Business Model Design	4	5
Intercultural Competencies	4	5
Modern Leadership	4	5

Marketing, Vertrieb, Medien (Master)

Fach	SWS	ECTS
Entrepreneurship Coaching	4	5
International Marketing	4	5

Retail and Consumer Management (Master)

Fach	SWS	ECTS
Digital Analytics and Artificial Intelligence in Retailing	4	5
Retail Lab: Consumer Projects and Project Management	4	5
Retail Locations and International Retailing	4	5

5   Module Descriptions

Corporate Finance	
Module abbreviation:	GBM_CF
Curriculum:	**Programmes**
	Global Economics and Business Management (GBM-B) - SPO-Nr.: 1
Responsible for module:	Graap, Torsten
Lecturers:	Graap, Torsten
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:	1.9: Corporate Finance (GBM_CF)
Lecture types:	Lecture with integrated exercises. The teaching method is a weekly lecture with exercise. The lecture provides an overview and students can apply their skills in the exercises consisting of tasks and case studies. Apart from that, they are required to solve problems by them-selves and/or as part of a group in preparation for their next lecture.

Studien- / Prüfungsleistungen:

1.9-Corporate Finance: schrP90 - written exam, 90 minutes (GBM_CF)

Additional Explanation:

None

Recommended prerequisites:

The students should have a basic knowledge of mathematics acquired in module 1.3 Quantitative Methods. Further knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.

Objectives:

1 Corporate Finance:

The Students

- know common financial instruments and are able to classify and describe them
- are able to outline the importance and message of the leverage effect
- can apply different methods of capital budgeting to derive investment decisions
- know about targets and problems in finance and investment in internationally operating companies

Content:

1 Corporate Finance:

- Definitions and basic concepts of financing and investment
- Overview of financial instruments and their functions
- Declaration and interpretation of important financial figures

- Significance of capital structure decisions: leverage effect
- Multinational capital structure and cost of capital
- Managing currency risk and country risk
- Various methods of capital budgeting

Literature:

Compulsory:

- BREALEY, Richard A., Stewart C. MYERS and Franklin ALLEN, 2017. *Principles of Corporate Finance*. New York: McGraw Hill. ISBN 978-1-259-25333-1
- EUN, Cheol S. and Bruce G. RESNICK, 2014. *International Finance*. 7. edition. Maidenhea: McGraw-Hill Education. ISBN 9780077161613
- MADURA, Jeff, 2014. *International Financial Management*. 3. edition. Stamford: Cengage Learning. ISBN 978-1-4080-7981-2
- BÖSCH, Martin, 2014. *Internationales Finanzmanagement: Rahmenbedingungen, Investition, Finanzierung und Risikomanagement*. Stuttgart: Schäffer-Poeschel. ISBN 978-3-7910-3350-1

Recommended:

- PAPE, Ulrich, 2015. *Grundlagen der Finanzierung und Investition: mit Fallbeispielen und Übungen [online]* [online]. Oldenbourg: De Gruyter PDF e-Book. ISBN 978-3-11-041388-5, 978-3-11-042564-2. Available via: https://doi.org/10.1515/9783110413885.
- BIEG, Hartmut, KUßMAUL, Heinz, WASCHBUSCH, Gerd, 2017. *Finanzierung in Übungen [online]* [online]. München: Franz Vahlen PDF e-Book. ISBN 978-3-8006-5340-9. Available via: https://doi.org/10.15358/9783800653409.
- BIEG, Hartmut, KUßMAUL, Heinz, WASCHBUSCH, Gerd, 2015. *Investition in Übungen [online]* [online]. München: Franz Vahlen PDF e-Book. ISBN 978-3-8006-4971-6. Available via: https://doi.org/10.15358/9783800649716.

Corporate Finance

Module abbreviation:	IG_CF

Curriculum:	**Programmes**
	International Management (IGB-B) - SPO-Nr.: 2

Responsible for module:	Habermann, Mandy
Lecturers:	Habermann, Mandy
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:	2.2: Corporate Finance (IG_CF)
Lecture types:	Lecture with integrated exercises. The teaching method is a weekly lecture with exercise. The lecture provides an overview and students can apply their skills in the exercises consisting of tasks and case studies. Apart from that, they are required to solve problems by them-selves and/or as part of a group in preparation for their next lecture.

Studien- / Prüfungsleistungen:

2.2-Corporate Finance: schrP90 - written exam, 90 minutes (IG_CF)

Additional Explanation:

None

Recommended prerequisites:

The students should have a basic knowledge of mathematics. Knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.

Objectives:

1 Corporate Finance:

The Students

- know common financial instruments and are able to classify and describe them
- are able to outline the importance and message of the leverage effect
- can apply different methods of capital budgeting to derive investment decisions
- know about targets and problems in finance and investment in internationally operating companies

Content:

1 Corporate Finance:

- Definitions and basic concepts of financial management and financial mathematics
- Overview of financial markets, financial instruments and their functions
- Characteristics of equity and it's valuation
- Characteristics of bonds and their valuation
- Cost of capital and capital structure: leverage effect, challenges at international level
- Capital budgeting: different methods and instruments, challenges at international level
- Risks in an international environment: managing currency and country risk

Literature:

Compulsory:

- KEOWN, Arthur J., John D. MARTIN and J. William PETTY, 2020. *Foundations of Finance, The Logic and Practice of Financial Management*. 10. edition. Harlow, Essex: Pearson. ISBN 978-1-292-31873-8; 978-1-292-31880-6
- BERK, JONATHAN and PETER DEMARZO, 2023. *Corporate Finance*. 6. edition. Harlow, Essex: Pearson. ISBN 978-1-292-44641-7

Recommended:

- MADURA, Jeff and Roland FOX, 2020. *International Financial Management*. 5. edition. Andover, Hampshire: Cengage. ISBN 978-1-4737-7050-8
- MOFFETT, MICHAEL H., ARTHUR I. STONEHILL and DAVID K. EITEMAN, 2021. *Fundamentals of Multinational Finance*. 6. edition. Harlow, Essex: Pearson. ISBN 978-1-292-21521-1; 978-1-292-21527-3
- BREALEY, Richard and others, 2023. *Principles of Corporate Finance*. 14. edition. New York: McGraw-Hill Education. ISBN 9781264080946
- EUN, Cheol S., Bruce G. RESNICK and Tuugi CHULUUN, 2023. *International financial management*. 10. edition. New York: McGraw-Hill Education. ISBN 978-1-266-22405-8

Cost Accounting and Cost Management

Module abbreviation:	GBM_CA&CM

Curriculum:	**Programmes**
	Global Economics and Business Management (GBM-B) - SPO-Nr.: 1

Responsible for module:	Schmidt, Karin
Lecturers:	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:	1.10: Cost Accounting and Cost Management (GBM_CA&CM)
Lecture types:	Lecture with integrated exercises

Studien- / Prüfungsleistungen:

1.10-Cost Accounting and Cost Management: schrP90 - written exam, 90 minutes (GBM_CA&CM)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

1 Cost Accounting and Cost Management:
The students are able to
- distinguish between financial accounting and cost accounting
- apply the appropriate vocabulary when talking about cost and pricing
- know about differences in cost accounting of German and Angloamerican systems
- calculate the cost per product and know how to detect cost inefficiencies
- explain different cost management techniques and know which one to apply in specific situations

The course basically adressed business competences, application strength, analytical competence as well as intercultural competence within our framework of learning obejctives.

Content:

1 Cost Accounting and Cost Management:
- Principles of cost accounting and cost management
- Cost accounting:
  - cost accounting techniques in different countries
  - process costing
  - cost center accounting
  - calculating the cost per product and per period
  - pricing a product
- Cost accounting systems and cost management techniques:
  - contribution margins
  - cost-volume-profit relationships
  - activity based costing

o	target costing
o	principles of planning and budgeting

Literature:

Compulsory:

- DATAR, Srikant M. and Madhav V. RAJAN, 2021. *Horngren's cost accounting: a managerial emphasis*. 17. edition. Harlow, England: Pearson. ISBN 978-1-292-36307-3
- DRURY, Colin and Mike TAYLES, 2023. *Management and cost accounting*. 12. edition. Andover: Cengage. ISBN 978-1473791244

Recommended:

- CAREY, Mary, Cathy KNOWLES and Jane TOWERS-CLARK, 2020. *Accounting: a smart approach*. 4. edition. Oxford: Oxford University Press. ISBN 978-0198844808
- SCHMIDT, Andreas, 2022. *Kostenrechnung: Grundlagen der Vollkosten-, Deckungsbeitrags- und Plankostenrechnung sowie des Kostenmanagements*. 9. edition. Stuttgart: W. Kohlhammer. ISBN 978-3-17-041110-4
- COENENBERG, Adolf G., Thomas M. FISCHER and Thomas GÜNTHER, 2016. *Kostenrechnung und Kostenanalyse*. 9. edition. Stuttgart: Schäffer-Poeschel Verlag für Wirtschaft Steuern Recht GmbH. ISBN 978-3-7910-3613-7

Current Issues in Economics

Module abbreviation:	IG_CIE

Curriculum:	**Programmes**
	International Management Bachelor (IG-B) - SPO-Nr.: 2

Responsible for module:	Schauberger, Katharina
Lecturers:	Schauberger, Katharina
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:	2.10: Current Issues in Economics (IG_CIE)
Lecture types:	Lecture with integrated exercises. The teaching method is a weekly lecture with exercise. The lecture provides an overview and students can apply their skills in the exercises consisting of tasks and case studies. Apart from that, they are required to solve problems by themselves and/or as part of a group in preparation for their next lecture.

Studien- / Prüfungsleistungen:

2.10-Current Issues in Economics: LN - written exam, 90 minutes (IG_CIE)

Additional Explanation:

None

Recommended prerequisites:

Basic knowledge of microeconomics and macroeconomics is required. An in-depth study of literature is highly recommended.

Objectives:

2 Current Issues in Economics:

The students

- have knowledge about the most important macroeconomic variables: gross domestic product, economic growth, inflation rate, unemployment rate and the current account balance.
- describe the role and functions of international organizations.
- can analyze and compare country indices.
- are able to understand and discuss the causes and consequences of major economic topics such as:
  - o global economic outlook
  - o the rise in inflation rates
  - o disruptions in international trade
  - o the economic aspects of climate change.

Content:

2 Current Issues in Economics:

- Introduction into major macroeconomic concepts: GDP/growth, inflation rate, unemployment rate, current account balance
- International organizations: theory and practical use
- Analysis of country indices
- Discussion of current economic topics:

o   Global economic outlook
o   Inflation
o   Disruptions in international trade
o   Economic aspects of climate change

Literature:

Compulsory:

- MANKIW, Nicholas Gregory and Mark P. TAYLOR, 2023. *Economics*. 6. edition. London: Cengage Learning. ISBN 978-1-4737-8698-1

- HURD, Ian, 2021. *International organizations: politics, law, practice*. 4. edition. Cambridge: Cambridge University Press. ISBN 978-1-108-84058-3, 978-1-108-81431-7

- Selected articles by international organizations and researchers.

- SCHOLING, E., 2006. Kinderarbeit. Eine ökonomische Analyse. In: Wirtschaftswissenschaftliches Studium: WiSt; Zeitschrift für Studium und Forschung. (2), p.82-86.

- BASU, Kaushik, VAN, Pham, Hoang, 1998. The Economics of Child Labor. In: *The American Economic Review*. **88**(3), p.412–427.

- FORSGREN, Mats, 2024. *Theories of the Multinational Firm. A Multidimensional Creature in the Global Economy*. 4. edition. Cheltenham, UK: Edward Elgar Publishing, Inc. ISBN 978 1 03533 596 1

Recommended:

- DORMAN, Peter, 2014. Macroeconomics: a fresh start [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-3-642-37440-1, 978-3-642-37441-8. Available via: https://doi.org/10.1007/978-3-642-37441-8.

- HEATHER, Ken and Simka STEFANOVA, 2017. Maths for economics: a companion to Mankiw and Taylor economics. Hampshire: Cengage Learning. ISBN 978-1-4737-2542-3

Digital Analytics and Artificial Intelligence in Retailing - Master

Module abbreviation:	RCM_DA&AIR_1.3 Ind. Elective

Curriculum:	**Programmes**
	Retail and Consumer Management (RCM-M) - SPO-Nr.: 1

Responsible for module:	Jungbluth, Michael
Lecturers:	Jungbluth, 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:	1.3: Digital Analytics and Artificial Intelligence in Retailing (RCM_DA&AIR_1.3 Ind. Elective)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

1.3-Digital Analytics and Artificial Intelligence in Retailing: project report. Practical work. Written composition approx. 10-15 pages with presentation 15-30 minutes. (RCM_DA&AIR_1.3 Ind. Elective)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

1 Digital Analytics and Artificial Intelligence in Retailing:

- As defined by the Digital Analytics Association, the analysis of digital data refers to information collected in interactive channels (online, mobile, social, etc.). Digital Analytics has become an integral part of core business strategies and maintaining a competitive edge.
- Students will learn essential contributions of applied data science, modern technology and artificial intelligence in retail and consumer commerce.
- Students will receive a profound overview on essential data science methodologies (descriptive, predictive, prescriptive), each within a dedicated retail business context. The course enables students to later act as cross-functional analytics "translators", not as functional experts.
- Analytics "translators" draw on their domain-, analytics- and technology know-how to help business leaders identify and prioritize their business problems while working closely with multiple functional experts and stakeholders.
- Students will understand, how predominantly digital challenges can be addressed and automated through analytics and AI to augment retail value chains for sustainable competitive advantages.

Content:

1 Digital Analytics and Artificial Intelligence in Retailing:

- Approximately 1/3 of each lesson will be devoted to the underlying analytics theory, to selected use cases within the field of retailing and to hands-on problem solving with open source software.
- We cover methods of data exploration, inference and hypothesis testing, clustering and segmentation, visualization and storytelling, regression, decision trees, experiments, testing and causation, recommendation engines, big data, machine learning and AI.
- Google Analytics will be introduced as the current market dominating digital analytics tool. Utilizing Google Analytics, students will learn how to use Digital Analytic software technology in the context of analytical, exploratory and reporting capabilities. Students will learn by doing: that is, guided by the

instructor and using software, they will focus on data discovery and communicating insights.

- Open source code will be provided as Google Collaboratory notebooks for best traceability and learning support for IT-savvy as well as non-IT-savvy students.

Literature:

Compulsory:

- KUMAR, U Dinesh, 2017. *Business Analytics: The Science of Data-Driven Decision Making*. India: Wiley. ISBN 9788126568772
- KAMKI, Jumin, 2017. *Digital Analytics: Data Driven Decision Making in Digital World*. 1. edition. ISBN 978-1946556196

Recommended:

- SPONDER, Marshall and Gohar F. KHAN, 2018. *Digital analytics for marketing*. New York and London: Routledge, Taylor & Francis Group. ISBN 978-1-138-19067-2, 978-1-138-19068-9
- MOKALIS, Alexa L. and Joel J. DAVIS, 2018. *Google Analytics Demystified*. 4. edition. ISBN 978-1545486917
- WHEELAN, Charles J., 2013. *Naked statistics: stripping the dread from the data*. 1. edition. New York [a.o.]: Norton & Company. ISBN 978-0-393-07195-5, 978-0-393-34777-7
- KAHN, Barbara E., 2021. *The Shopping Revolution, Updated and Expanded Edition: How Retailers Succeed in an Era of Endless Disruption Accelerated by COVID-19*. ISBN 978-1613631140
- SCHMARZO, Bill, 2020. *The Economics of Data, Analytics and Digital Transformation: The theorems, laws and empowerments to guide your organization's digital transformation*. 1. edition. Birmingham - Mumbai: Packt Publishing. ISBN 978-1800561410

Digital Biotechnology and Bio Revolution

Module abbreviation:	LSM_DBBR

Curriculum:	**Programmes**
	Life Science Management (LSM-B) - SPO-Nr.: 2

Responsible for module:	Schuhmacher, Alexander
Lecturers:	Schuhmacher, 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:	2.10: Digital Biotechnology and Bio Revolution (LSM_DBBR)
Lecture types:	2.10-Digital Biotechnology and Bio Revolution: SU/Ü - lecture with integrated exercises (LSM_DBBR)

Studien- / Prüfungsleistungen:

2.10-Digital Biotechnology and Bio Revolution: LN - seminar paper/presentation (LSM_DBBR)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

Upon successful completion of this module, students are able ...

(1) Professional competencies

... to understand how the biotech business works and how it changes.

... to outline the various (digital and biomedical) emerging technologies.

... to differentiate the various technologies and their impact on the biotech sector and the business of the fu-ture.

(2) Methodological competencies

... to systematically review the impact of new technologies on the biotech business.

... to execute team work.

... to generate new technical depth and breadth in the field of biotechnology.

... analyze scientific information systematically.

(3) Personal competencies

... to apply analytical thinking.

... to analyze various scenarios and judge proactively.

... to evaluate scientific information in a business context.

Content:

Digital biotechnology and bio-revolution:

- Basics and principles of CRISPR/Cas9 and other breakthrough biotech technologies and their impact on businesses, societies and the future

- Biology as an engineering technology and the new power to control evolution

- Artificial intelligence (AI) technologies (e.g. machine learning, neural networks, ...) and their applications in

healthcare
- AI applications in pharmaceutical R&D
- AI applications in project management
- Big tech (Alphabet, IBM, Apple, Amazon, Microsoft) in healthcare, new disruptive business models revolutionizing healthcare of tomorrow

Literature:
Compulsory: - AGRAWAL, A., J. GANS und A. GOLDFARB, 2018. Prediction Machines: The Simple Economics of Artificial Intelligence.   - BRYNJOLFSSON, E., MCAFEE, A., 2017. The business of artificial intelligence: What it can - and cannot - do for your organization. In: Harvard Business Review.   - CHUI, M., MANYIKA, J., MIREMADI, M., HENKE, N., CHUNG, R., NEL, P., MALHOTRA, S. Notes from the AI frontier: Insights from hundreds of use cases [online]. Verfügbar unter: https://www.mckinsey .com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-applications-and-value-of- deep-learning   - CHUI, M., The Bio Revolution. [online]. [Zugriff am: 27.6.2021]. Verfügbar unter: https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/the-bio-revolution-innovations-transforming-economies-societies-and-our-lives   *Recommended:* None

Digital Transformation & Business Models

Module abbreviation:	IG_DTBM

Curriculum:	**Programmes**
	International Management Bachelor (IG-B) - SPO-Nr.: 1

Responsible for module:	Faulbacher, Michael; Locher, Christian
Lecturers:	Faulbacher, Michael; Locher, 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:	1.4: Digital Transformation & Business Models (IG_DTBM)
Lecture types:	1.4: SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

1.4-Digital Transformation & Business Models: schrP90 - written exam, 90 minutes (IG_DTBM)
Additional Explanation:
None

Recommended prerequisites:

Knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.

Objectives:

1 Digital Transformation & Business Models:
Students
- have a basic understanding of the effects of digitalization on individuals, the society and firms
- know exemplary digital business models and are aware of the core principles to build them
- understand the challenge of digital transformation for traditional companies
- understand the importance of entrepreneurship
- are able to create, scope and document a simple digital business model with instruments like the business model canvas
- understand the importance of data and technology
- know how to accelerate innovation by means of transformation

Content:

1 Digital Transformation & Business Models:
- Digitization, Digitalization, Digital Transformation
- Digital transformation in practice
- Business Model Canvas
- Operating Model Canvas
- Pitches

Literature:

Compulsory:
- ROGERS, D.L., 2016. *Digital transformation playbook: Rethink your business for the digital age.*
Recommended:

None

Entrepreneurial Methods - **Master**

Module abbreviation:	EDB_EM

Curriculum:	**Programmes**
	Entrepreneurship and Digital Business (EDB-M) - SPO-Nr.: 4

Responsible for module:	Huber, Florian
Lecturers:	Huber, Florian
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:	4.1: Entrepreneurial Methods (EDB_EM)
Lecture types:	S: seminar

Studien- / Prüfungsleistungen:

4.1-Entrepreneurial Methods: project work (EDB_EM)

Additional Explanation:

None

Recommended prerequisites:

There are no prerequisites. However, it is recommended that you develop at least a rudimentary understanding of the German startup eco-system before you start the course. For example, you could start by familiarizing yourself with the most current "Deutscher Startup Monitor" report.

Objectives:

4 Entrepreneurial Methods:

The goal of this course is to develop an understanding of prominent contemporary themes in entrepreneurship. This will provide a common ground for several other courses in the Entrepreneurship and Digital Business master's programme.

The course will be guided by the following learning goals:

- Students are comfortable with discussing entrepreneurship-related theories, models, and ideas.
- Students can reflect on what entrepreneurship is and have developed a personal position towards entrepreneurship.
- Students are capable of listing different contemporary theories and models of entrepreneurship and can critically differentiate between them.
- Students understand different dimensions of entrepreneurial traits, principles, and beliefs and can actively evaluate and develop their own entrepreneurial profile.
- Students know about common development stages, business models, and funding sources of startups and can translate their knowledge into actionable guidelines for real startups.

Content:

4 Entrepreneurial Methods:

This course equips students with a critical understanding of some of the core issues regarding contemporary entrepreneurship. It provides different theories and frameworks that allow students to construct and reflect on their own position towards entrepreneurship. The course is broken up into multiple parts consisting of two to three weeks each. The taught content is used as a starting point for various in-class discussions and exercises as well as small take-home assignments. The following questions provide a rough outline of the course content:

Part 1: Entrepreneurship today

- What is entrepreneurship today and why is it so popular?
- How are startups different than larger established organizations?
- Are there different types of entrepreneurship?
- How does the entrepreneurship landscape in Germany and other places in the world look like?

Part 2: Being an entrepreneur

- What does it mean to be an entrepreneur?
- Are there common personality or character traits, beliefs, principles, or behaviours that distinguish entrepreneurs?
- How do entrepreneurs work together in teams?

Part 3: Theories of entrepreneurship

- How did entrepreneurship theory develop over the last three centuries?
- What is Lean Startup and how did it develop?
- What is effectuation in the context of entrepreneurship?
- What is Design Thinking and how can it be applied to entrepreneurship?
- What is Disciplined Entrepreneurship and how can it be applied to new venture building?

Part 4: Basic concepts of startup development

- What are typical development stages and challenges of startups?
- What types of data-driven business models exist?
- What are different funding sources for startups and what is the role of investors?
- How can you determine the future value of a startup?

Literature:

Compulsory:

- Without author. *Deutscher Startup Monitor* [online]. Available via: https://deutscherstartupmonitor.de/
- GEDEON, Steve. *What is entrepreneurship?* [online]. Available via: https://www.academia.edu/35644718/What_is_Entrepreneurship
- Without author. *GEM Global Report* [online]. Available via: https://www.gemconsortium.org/
- SARASVATHY, Saras D. *Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency* [online]. Available via: http://entrepreneurscommunicate.pbworks.com/f/2001_Sarasvathy_Causation+adn+effectuation.pdf
- BRANDSTÄTTER, Hermann. *Personality aspects of entrepreneurship: A look at five meta-analyses, Personality and Individual Differences* [online]. Available via: https://www.researchgate.net/publication/232388037_Personality_Aspects_of_Entrepreneurship_A_Look_at_Five_Meta-Analyses

Recommended:

- AULET, Bill and Marius URSACHE, 2013. *Disciplined entrepreneurship: 24 steps to a successful startup*. Hoboken, NJ: Wiley. ISBN 978-1-118-69228-8, 978-1-118-72088-2
- GASSMANN, Oliver, Karolin FRANKENBERGER and Michaela CHOUDURY, 2020. *The business model navigator: the strategies behind the most successful companies*. 2. edition. Harlow, England: Pearson. ISBN 978-1-292-32712-9
- RIES, Eric, 2011. *The lean startup: how constant innovation creates radically successful businesses*. London [u.a.]: Portfolio Penguin. ISBN 978-0-670-92160-7
- UEBERNICKEL, Falk and others, 2020. *Design thinking: the handbook*. Singapore: World Scientific. ISBN 978-981-12-0214-8, 978-981-12-0350-3
- SCHIRMER, Julian, EBER, René, BOURDON, Isabelle. *32 ways to innovate business models through data: Emerging data-driven solution business model patterns from a study of 471 late stage data-driven startups* [online]. Available via: https://scholarspace.manoa.hawaii.edu/handle/10125/71226

Entrepreneurship Coaching - Master

Module abbreviation:	MVM_EC

Curriculum:	**Programmes**
	Marketing, Vertrieb und Medien (MVM-M) - SPO-Nr.: 4

Responsible for module:	Bader, Martin
Lecturers:	Bader, 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:	4: Entrepreneurship Coaching (MVM_EC)
Lecture types:	S: seminar

Studien- / Prüfungsleistungen:

4-Entreperneurship Coaching: project report (MVM_EC)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

10 Entrepreneurship Coaching:

After successful participation in the module course, students are able to:

- analyze customer and market needs on basis of advanced design thinking approaches,
- develop and assess a business idea on this basis and apply it to a consistent business model,
- identify and analyze key success factors for implementation,
- prepare and apply implementation on basis of a minimal viable product approach,
- apply the agile business development, prototype testing and lean startup methods and integrate the principles of entrepreneurial thinking in business and leadership,
- prepare participation in a business plan competition at graduate level and to meet the specific challenges,
- successfully integrate the listed competencies with the content of other modules from their degree program and develop new, overarching approaches.

Content:

10 Entrepreneurship Coaching:

- Ideation
- Value Proposition Design
- Business Model Canvas
- Business Model Innovation
- Minimal Viable Product & Preto-/Prototyping
- Business Planning
- Pitching

Literature:

Compulsory:

- AULET, Bill, Thomas DEMMIG and Marius URSACHE, 2013. *Disciplined entrepreneurship: 24 steps to a successful startup*. Hoboken, NJ: Wiley. ISBN 978-1-118-69228-8, 978-1-118-72088-2
- BAYSTARTUP GmbH, 2022. Handbuch Businessplan-Erstellung, Der Weg zum erfolgreichen Unternehmen. [online]. https://www.bay-startup.de/startups/handbuch-businessplan-erstellung: BayStartUP GmbH, 18.07.2022 [Accessed on: 18.07.2022]. Available via: https://www.bay-startup.de/fileadmin/Dokumente/Downloads/Handbuch_Businessplan_Erstellung.pdf

Recommended:

- KAWASAKI, Guy, 2015. The art of the start 2.0: The time-tested, battle-hardened guide for anyone starting anything. London: Portfolio Penguin. ISBN 978-0-241-18726-5, 978-1-59184-811-0
- 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
- FUEGLISTALLER, Urs, FUST, Alexander, MÜLLER, Christoph, MÜLLER, Susan, ZELLWEGER, Thomas, 2019. *Entrepreneurship: Modelle – Umsetzung – Perspektiven: Mit Fallbeispielen aus Deutschland, Österreich und der Schweiz* [online]. Wiesbaden: Springer Gabler PDF e-Book. ISBN 978-3-658-26800-8. Available via: https://doi.org/10.1007/978-3-658-26800-8.
- GASSMANN, Oliver, Karolin FRANKENBERGER and Michaela CSIK, 2017. *Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler Business Model Navigator*. 2. edition. München: Hanser. ISBN 978-3446451759
- GASSMANN, Oliver, Karolin FRANKENBERGER and Michaela CHOUDURY, 2020. *Business Model Navigator: The Strategies Behind the Most Successful Companies*. 2. edition. Harlow: Pearson. ISBN 978-1292327129
- OSTERWALDER, Alexander and Yves PIGNEUR, 2010. Business Model Generation: Ein Handbuch für Visionäre, Spielveränderer und Herausforderer. ISBN 978-3-593-39474-9
- OSTERWALDER, Alexander and Yves PIGNEUR, 2014. Value Proposition Design: How to Create Products and Services Customers Want. ISBN 978-1118968055

Global Business and Economics 1 - Master

Module abbreviation:	GBU_GBE1	

Curriculum:	**Programmes**	
	Global Business (GBU-M) - SPO-Nr.: 1	

Responsible for module:	Vogler, Thomas
Lecturers:	Vogler, Thomas
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 (GBU_GBE1)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

1-Global Business and Economics 1: schrP90 written examination 90 minutes (GBU_GBE1)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

1 Global Business and Economics 1:
- Students learn to understand the impact of globalization on business and the global economy.
- Students learn to analyze the competitive environment in global markets.
- Students learn to develop cross-cultural communication and negotiation skills.
- Students learn to identify opportunities and challenges presented by emerging markets.

Content:

1 Global Business and Economics 1:
- Understanding globalization and its impact on business
- Theories of international trade and investment
- Analyzing the competitive environment in global markets
- Global supply chain management and logistics
- Corporate social responsibility in a global context
- Cross-cultural communication and negotiation skills
- Emerging markets and the challenges and opportunities they present
- Emerging issues in global economics, such as climate change and inequality
- The role of culture and social norms in global economics
- Ethical considerations in global economics and business practices

Literature:

Compulsory:
None
Recommended:
- VELASQUEZ, Manuel G., 2013. *Business Ethics: Concepts and Cases*. 7. edition. 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 Model Design - Master

Module abbreviation:	GBU_GBMD

Curriculum:	**Programmes**
	Global Business (GBU-M) - SPO-Nr.: 3

Responsible for module:	Vogler, Thomas
Lecturers:	Vogler, Thomas
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: Global Business Model Design (GBU_GBMD)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

3-Global Business Model Design: seminar paper and presentation (GBU_GBMD)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

3 Global Business Model Design:
- Students learn to understand different business models and how they apply to global markets.
- Students learn to identify sources of competitive advantage in global business.
- Students learn to design a global value chain that maximizes efficiency and effectiveness.
- Students learn to develop global marketing strategies.
- Students will play a business simulation in teams. Our teams will play against students from a northern German university.

Content:

3 Global Business Model Design:
- Understanding different business models and how they apply to global markets
- Identifying sources of competitive advantage in global business
- Designing a global value chain that maximizes efficiency and effectiveness
- Developing global marketing strategies
- Understanding the role of technology in global business model design
- Innovating and adapting business models to changing global conditions
- Analyzing the impact of cultural differences on business models
- Identifying and managing risks in global business models
- Balancing local and global needs in business model design
- Business Simulation

Literature:

Compulsory:
None

Recommended:

- HILL, Charles W. L. and G. Tomas M. HULT, 2020. *Global Business Today*. 11. edition. New York, NY: McGraw-Hill Education. ISBN 978-1-260-56581-2
- KEEGAN, Warren J. and Mark C. GREEN, 2020. *Global marketing*. T. edition. Harlow, England: Pearson. ISBN 978-1-292-30402-1, 1-292-30402-2

Global Supply Chain Management

Module abbreviation:	IG_GSCM

Curriculum:	**Programmes**
	International Management Bachelor (IG-B) - SPO-Nr.: 2

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:	2.4: Global Supply Chain Management (IG_GSCM)
Lecture types:	2.4: SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2.4-Global Supply Chain Management: schrP90 - written exam, 90 minutes (IG_GSCM)
Additional Explanation:
None

Recommended prerequisites:

Knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.

Objectives:

2 Global Supply Chain Management:
The students know
- and apply concepts, methods and contribution of logistics to the success of international organizations.
- about the very critical impact that Supply Chain Management could exert on the profitability of an organization.

The students
- understand the challenges and opportunities of global supply chains
- understand that control of the critical factors is vital for maximizing the returns and staying ahead of competition through lower cost

Content:

2 Global Supply Chain Management:
- Fundamentals of supply chain and basic terms
- Role of purchase management and supply chain management in terms of finance and cost
- Origin and concepts of purchase management: profit centre concept, integrated concept, centralization vs. decentralization
- Purchase policies and procedures, purchase cycle / ordering systems, make or buy decisions
- Legal and economic aspects of purchase, delivery, transport logistic and transfer of risk in a supply chain
- Types of inventories, need for inventory control, factors influencing inventory, mechanics of inventory control and systems
- Requirement to understand the supply chain from the perspective of a purchase manager
- Supply chain performance: achieving strategic fit and scope
- Supply chain drivers and metrics

- Designing distribution networks and applications to e-business
- Network design of supply chain
- Designing global supply chain networks
- Coordination in a supply chain

Literature:

Compulsory:

- CHOPRA, Sunil, 2019. *Supply Chain Management: Strategy, Planning, and Operation*. 7. edition. Upper Saddle River, N.J.: Pearson.
- STADTLER, Hartmut, Christoph KILGER and Herbert MEYR, 2016. *Supply Chain Management and Advanced Planning: Concepts, Models, Software, and Case Studies*. 5. edition. Berlin, Heidelberg: Springer.

Recommended:

None

HR Management, Organization and Leadership

Module abbreviation:	GBM_HRMOL

Curriculum:	**Programmes**
	Global Economics and Business Management (GBM-B) - SPO-Nr.: 1

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:	1.11: HR Management, Organization and Leadership (GBM_HRMOL)
Lecture types:	Lecture with integrated exercises. The teaching method is a weekly lecture with exercise. The lecture provides an overview and students can apply their skills in the exercises consisting of tasks and case studies. Apart from that, they are required to solve problems by themselves and/or as part of a group in preparation for their next lecture as well as their Seminar paper and presentation.

Studien- / Prüfungsleistungen:

1.11-HR Management, Organization and Leadership: schrP90 - written exam, 90 minutes (GBM_HRMOL)
Additional Explanation:
None

Recommended prerequisites:

Knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.

Objectives:

1 HR Management, Organization and Leadership:
The students
- know about the extraordinary influence of HR in international companies
- have a decent overview of HR management and organisation as well as different practices to lead and motivate people

The students are able to
- master challenges in HR related topics
- are able to make decisions for different organisational structures and see the impacts on leadership

Content:

1 HR Management, Organization and Leadership:
- Basics in HR Management + Strategic HR Management
- Globalisation of HR
- Aspects of labour law
- Functions and tasks within HR management like staffing, development and performance management in the multinational context
- Theories of leadership
- International HR Management & Culture

Literature:

Compulsory:

- DOWLING, Peter J., Marion FESTING and Allen D. ENGLE, 2017. *International Human Resource Management*. 7. edition. Andover: Cengage Learning. ISBN 978-1473719026

Recommended:

- BERTHEL, Jürgen and Fred G. BECKER, 2017. *Personal-Management*. 11. edition. Stuttgart: Schäffer Poeschel. ISBN 978-3-7910-3737-0
- DESSLER, Gary, 2017. *Human Resource Management*. 15. edition. Upper Saddle River: Pearson. ISBN 978-1-292-15210-3; 1-292-15210-9
- EISELE, Daniela and Claudia LIESKE, 2022. *Praxisorientierte Personalwirtschaftslehre: Wertschöpfungskette Personal*. 8. edition. Stuttgart: Kohlhammer. ISBN 978-3-17-037784-4
- TORRINGTON, Derek and OTHERS, 2017. *Human Resource Management*. 10. edition. Harlow: Prentice Hall. ISBN 9781292129099

Intercultural Business and Business in China - Master

Module abbreviation:	FMC_MgmtElect II_IBBC

Curriculum:	**Programmes**
	Financial Management und Controlling (FMC-M) - SPO-Nr.: 10

Responsible for module:	Chen, Jing
Lecturers:	Chen, Jing; McDonald, James
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:	10: Intercultural Business and Business in China (FMC_MgmtElect II_IBBC)
Lecture types:	Lecture with integrated exercises.

Studien- / Prüfungsleistungen:

10-Intercultural Business and Business in China: LN - seminar paper/presentation (FMC_MgmtElect II_IBBC)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

10 Intercultural Business and Business in China:
The students
- 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

Content:

10 Intercultural Business and Business in China:
- Importance of intercultural management for companies doing business abroad
- Theories of culture
- Concepts of intercultural management and communication
- Organisation and leadership in international teams

Literature:

Compulsory:
- HOFSTEDE, Geert, 2003. *Cultures and organizations: software of the mind; [intercultural cooperation and its importance for survival]*. R. edition. New York [u.a.]: McGraw-Hill. ISBN 0-07-029307-4
- TROMPENAARS, Fons and Charles HAMPDEN-TURNER, 2002. *Riding the waves of culture: understanding cultural diversity in business*. 2. edition. London: Brealey. ISBN 1-85788-176-1

Recommended:
None

Intercultural Competencies - **Master**

Module abbreviation:	GBU_IC

Curriculum:	**Programmes**
	Global Business (GBU-M) - SPO-Nr.: 2

Responsible for module:	Ferrell, Beroz
Lecturers:	Ferrell, Beroz
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: Intercultural Competencies (GBU_IC)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2-Intercultural Competencies: seminar paper and presentation (GBU_IC)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

2 Intercultural Competencies:
- An enhanced understanding of issues related to diversity and intercultural communication
- An increased commitment to valuing similarities and differences in individuals
- An increased understanding of how individual differences can strengthen a group or organization
- An enhanced ability to be open to discussions about the deeper implications of diversity and intercultural communication through dialogue
- The ability to apply learning to real world experience in global business

Content:

2 Intercultural Competencies:
- Cultural intelligence and its importance in global business
- Developing empathy and cultural sensitivity
- Overcoming stereotypes and biases in cross-cultural contexts
- Understanding cultural differences and their impact on business interactions
- Communication skills for multicultural environments
- Strategies for building trust across cultures
- Resolving conflicts in intercultural settings
- 5 Core skills for being effective in a diverse world
- Demonstrate learning through the completion of assigned reading, research, class participation, group projects and presentations

Literature:

Compulsory:
- Course Workbook with relevant learning materials and tools (downloadable on Moodle) to be brought to

class.

Recommended:

- BANAJI, Mahzarin R. and Anthony G. GREENWALD, 2013. *Blindspot: hidden biases of good people*. New York: Delacorte Press. ISBN 978-0-553-80464-5, 978-0-440-42329-4
- MEYER, Erin, 2015. *The culture map: decoding how people think, lead, and get things done across cultures*. 1. edition. New York, NY: PublicAffairs. ISBN 978-1-61039-276-1

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 (BW_UR5)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2.3-International Accounting and Auditing: LN - written exam, 90 minutes (BW_UR5)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

2 International Accounting and Auditing:
The students:
- 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:

2 International Accounting and Auditing:
International accounting
- 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:
- 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 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 (IG_TOPSIM)
Lecture types:	2.13: SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2.13-International Business Simulation: LN - seminar paper (IG_TOPSIM)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

2 International Business Simulation:

The students will be able to
- 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 communication skills, team work, and work delegation

Content:

2 International Business Simulation:

The business simulation (TOPSIM Mastering Business Operations) is a sophisticated, computerized business simulation game. Together with fellow players, students simulate a management team, which is responsible for running a business in national and international markets. The objective of the game is to train students to decide on complex business situations and so acquire general management skills and an overall view of management.

Besides running the simulation, the students have to prepare papers on strategic decisions and capital market decisions. The business simulation concludes with a simulation of a general meeting.

Literature:

Compulsory:
- The Simulation Game Handbook will be handed out in the course / will be shared in Moodle.

Recommended:

- *None*

International Marketing - Master

Module abbreviation:	MVM_IM

Curriculum:	**Programmes**
	Marketing, Vertrieb, Medien (Master) (MVM-M) - SPO-Nr.: 1

Responsible for module:	Scheed, Bernd
Lecturers:	Islam, Tas; Scheed, Bernd
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:	1.2: International Marketing (MVM_IM)
Lecture types:	Seminar course with exercises/business simulation

Studien- / Prüfungsleistungen:

1.2-International Marketing: schrP90 - written exam, 90 minutes (MVM_IM)

Additional Explanation:

None

Recommended prerequisites:

An intensive preparatory reading of the bibliography (s. below) is required.

Objectives:

1 International Marketing:

Students acquire application- and practice-oriented in-depth knowledge on managing international marketing and sales environments. They will be able to successfully integrate these competencies with the content of other modules from MVM (in particular the modules M1 "Market research" and V3 "Customer Behaviour and Customer Management") and develop overarching and new approaches from them.

In detail, students acquire the following competences:

- Students analyse key challenges of the International Marketing Environment, apply them in the context of real-life business cases and execute market attractiveness assessments for selecting international B2B and B2C markets.
- Students evaluate international market entry strategy options and develop a case-study based market entry strategy.
- Students apply and experiment with the extended set of models and levers in the international marketing mix. They reflect, assess and experiment with global decisions on product portfolio, brand, pricing, distribution and communications.
- Students successfully execute an international marketing & sales business simulation, integrating learnings on international marketing strategy and on interdependent international marketing mix decisions in the simulation decision flow.
- In the context of the real-life business simulation
  o students permanently analyse the dynamic competitive landscape and the macroeconomic environment,
  o create and later update a detailed marketing plan as well as a quantitative market model and
  o design and check a KPI-based measurement system for marketing and sales

Content:

1 International Marketing:

Introduction to International Marketing
- Globalization and Global markets
- Nature, Motives and Issues in International Marketing
- The Standardization vs. Adaptation Paradigm
- International Management Orientations (Perlmutter Model)
- Evolution of International Marketing

Global Marketing Environment
- Economic Environment and Trade Agreements
  - The World Economy
  - The Role of WTO
  - Nature and Types of Trade Agreements
  - Political Influence on International Marketing
- Social and cultural environments
  - Culture in Marketing
  - Global Consumer Cultures
  - Key Cultural Frameworks (Hall, Hofstede, GLOBE)
  - International Innovation Diffusion

Strategies for Approaching Global Markets
- Segmentation, Targeting and Positioning
  - STP Model in International Marketing
  - Global Market Segmentation
  - Target Market Strategy Options
  - Global Positioning Strategies
- Market selection decisions
  - Market Selection Criteria
  - Market Entry Timing
  - Market Entry Modes
- Importing and Exporting
  - Options for Exporting
  - Export Issues
  - Governmental role in imports/exports
  - Tariff Systems
  - Export Financing
- Licensing, Investment and Strategic Alliances
  - Options for Market Entry Strategies
  - Licensing in international context
  - Franchising in international context
  - Joint Ventures in international context
  - Foreign Direct Investment (FDI)
  - Global Strategic Alliances

Global Marketing Mix
- Global Brand and Product Decisions
  - Product Standardization vs. Adaptation
  - International Branding
  - Product / Brand Mix in international context
  - Country of Origin Approach
  - Global Product Planning
  - Product Counterfeiting & Product Piracy
- Global Pricing Decisions
  - Pricing Standardization vs. Adaptation

- - Global Pricing Strategies
  - Rationale for Gray Market Deals
  - Export Pricing & Incoterms
  - Key influence factors on International Pricing (Currency Fluctuation, Inflation, Government control, Competition)
- Global Distribution Decisions
  - Options for International Sales Channels
  - Selecting Foreign Distributors & Distributor Agreements
  - Global Retailing
- Global Communications Decisions
  - Communications Standardization vs. Adaptation
  - Global Advertising
  - Global Media Decisions
  - Public Relations in international context
  - Sales promotion in international context

Literature:

Compulsory:

- HOLLENSEN, Svend, 2020. *Global marketing: a decision-oriented approach*. 8. edition. ISBN 1292251808
- KEEGAN, Warren J. and Mark C. GREEN, 2019. *Global marketing*. t. edition. Boston, Mass.: Pearson. ISBN 978-1292304021; 1292304022

Recommended:

- BAACK, Daniel, Barbara CZARNECZKA and Donald BAACK, 2018. *International Marketing*. 2. edition. ISBN 978-1506389219
- DOOLE, Isobel, Robin LOWE and Alexandra J. KENYON, 2019. *International marketing strategy: analysis, development and implementation*. e. edition. Andover, Hampshire: Cengage. ISBN 978-1-4737-5874-2
- GHAURI, Pervez N. and Philip R. CATEORA, 2014. *International marketing*. 4. edition. London [u.a.]: McGraw-Hill. ISBN 978-0-07714815-7, 0-07714815-0
- KOTABE, Masaaki and Kristiaan HELSEN, 2022. *Global marketing management*. 9. edition. Hoboken, NJ: Wiley. ISBN 978-1119888765
- USUNIER, Jean-Claude, Julie Anne LEE and Vasyi TARAS, 2023. *Business & Marketing Across Cultures*. 1. edition. ISBN 978-1529754377

International Project

Module abbreviation:	IG_Proj

Curriculum:	**Programmes**
	International Management Bachelor (IG-B) - SPO-Nr.: 2

Responsible for module:	Augsdörfer, Peter
Lecturers:	Augsdörfer, Peter
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:	2.12: International Project (IG_Proj)
Lecture types:	2.12: Prj - Project

Studien- / Prüfungsleistungen:

2.12-International Project: seminar paper and presentation (IG_Proj)

Additional Explanation:

None

Recommended prerequisites:

Knowledge beyond the university entrance qualification is not required. An in-depth study of literature is highly recommended.

Objectives:

2 International Project:

The students will be able to:

- Define and describe common project management terminology
- Use general project management tools to coordinate a team and document the progress of a project
- Avoid common cultural pitfalls and mistakes in managing projects
- Define their role in the global project management process
- Present key project data to an international audience

This course develops a foundation of concepts and solutions that supports the planning, scheduling, controlling, resource allocation, and performance measurement activities required for successful completion of an international project.

Content:

2 International Project:

The students work together in an international project. The aim is to learn and apply the following project management aspects and apply them in practice:

- Project management tools, methods and techniques
- Running and coordinating an interdisciplinary and international project
- Planning, scheduling, resource allocation, making decisions
- Realisation and controlling
- Regulation and performance measurement activities
- Visualisation and communication
- Conflict management
- Case studies

• Marketing and communications inputs

Literature:

Compulsory:

- KOSTER, Kathrin, 2009. *International Project Management*. ISBN 1412946212

Recommended:

- NICHOLAS, John M. and Herman STEYN, 2016. *Project Management for Engineering, Business and Technology*. 5. edition. ISBN 1138937347

Lean Analytics - Master

Module abbreviation:	EDB_LA

Curriculum:	**Programmes**
	Entrepreneurship and Digital Business (EDB-M) - SPO-Nr.: 2

Responsible for module:	Bader, Martin
Lecturers:	Bader, Martin; Huber, Florian
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:	2.1: Lean Analytics (EDB_LA)
Lecture types:	SC / E: seminar course with exercises

Studien- / Prüfungsleistungen:

2.1-Lean Analytics: schrP90 - written exam, 90 minutes (EDB_LA)

Additional Explanation:

None

Recommended prerequisites:

There are no prerequisites. However, this course covers several perspectives and methods in a short time. As a learner, you will be better able to grasp, discuss, and apply these, if you have a basic understanding of the core ideas of Lean Startup (Ries, 2011), Lean Analytics (Croll & Yoskovitz, 2013), as well as pretotyping and prototyping (Savoia, 2019). Besides the books mentioned below, there are many online videos and articles available that provide an excellent introduction to each of these themes.

Objectives:

2 Lean Analytics:

This course aims to equip students with a comprehensive understanding and the corresponding skill set for making data-informed decisions in new business ventures.

The course will be guided by the following learning goals:

- Students are familiar with the core concepts of the Lean Startup methodology.
- Students understand the role of Lean Analytics in building a new business venture.
- Students know about different pretotyping/prototyping strategies and tools.
- Students are capable of creating useful learning metrics and measurement baselines.
- Students are confident about designing effective prototypes as well as testing their prototypes.
- Students have the necessary skills to run structured experiments and A/B tests.
- Students can make data-informed decisions about a new venture or idea.

Content:

2 Lean Analytics:

In this course, three main themes will be covered. First, we will explore the core concepts and practices of the Lean Startup methodology as the theoretical foundation for this course. Second, we will dive deeper into all aspects of how a Lean Analytics approach can be used to make better strategic decisions while building a new venture. Third, we will expand our toolkit by studying different pretotyping and prototyping strategies that allow us to design effective experiments.

Theme 1: Lean Startup

- Which principles guide the Lean Startup methodology?
- How do entrepreneurial and traditional managerial thinking differ?
- How can product development be aligned to maximize early learning opportunities?
- How does the build-measure-learn feedback loop work?

Theme 2: Lean Analytics

- What are the underlying principles of the Lean Analytics approach?
- What are learning metrics and how can they be created?
- How do you systematically collect and analyse data via structured experiments?
- What is the role of baselining and benchmarking in Lean Analytics?
- How do you use Lean Analytics to make data-informed decisions?

Theme 3: Pretotyping and prototyping

- What are pretotyping and prototyping?
- Which ethical boundaries should be considered while testing prototypes?
- Pretotyping and prototyping strategies and tools
- Integrating metrics and prototyping

Literature:

Compulsory:

- CROLL, Alistair and Benjamin YOSKOVITZ, 2013. *Lean analytics: use data to build a better startup faster*. 1. edition. Beijing [u.a.]: O'Reilly. ISBN 978-1-449-33567-0, 1-449-33567-5
- RIES, Eric, 2019. *The lean startup: how constant innovation creates radically successful businesses*. London [u.a.]: Penguin Business. ISBN 978-0-670-92160-7

Recommended:

- KONING, Rembrand, HASAN, Sharique, CHATTERJI, Aaron. *Experimentation and startup performance: Evidence from A/B testing (NBER Working Paper Series No. 26278)* [online]. [Accessed on:]. Available via: http://www.nber.org/papers/w26278
- SAVOIA, Alberto, 2019. *The right it: why so many ideas fail and how to make sure yours succeed*. 1. edition. New York, NY: HarperOne. ISBN 978-0-06-288465-7, 978-0-06-288466-4

Marketing

Module abbreviation:	BW_Mark

Curriculum:	**Programmes**
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 1

Responsible for module:	Hackl, Oliver
Lecturers:	Hackl, Oliver; Raab-Kuchenbuch, 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:	1.13: Marketing (BW_Mark)
Lecture types:	SU - seminaristischer Unterricht

Studien- / Prüfungsleistungen:

1.13-Marketing: schrP90 - written exam, 90 minutes (BW_Mark)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

1 Marketing:

The students will be able to:

- define the nature, function and basic principles of marketing.
- describe the strategic planning processes of a company in order to understand marketing as a market driven philosophy.
- apply the marketing research process as a framework to analyze broad and task marketing environment of a company.
- understand the nature of positioning and differentiation.
- describe the concept and key elements of the marketing mix and their application.
- solve case studies on realistic marketing problems.

Content:

1 Marketing:

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

2. 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:

Compulsory:

- KOTLER, Philip, Kevin Lane KELLER and Alexander CHERNEV, 2022. *Marketing management*. 16. edition. Harlow, England: Pearson. ISBN 978-1-292-40481-3

Recommended:

- 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

Marketing and Sales

Module abbreviation:	GBM_M&S

Curriculum:	**Programmes**
	Global Economics and Business Management (GBM-B) - SPO-Nr.: 1

Responsible for module:	Hackl, Oliver
Lecturers:	Hackl, Oliver; Raab-Kuchenbuch, 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:	1.8: Marketing and Sales (GBM_M&S)
Lecture types:	Lecture with integrated exercises

Studien- / Prüfungsleistungen:

1.8-Marketing and Sales: schrP90 - written exam, 90 minutes (GBM_M&S)

Additional Explanation:

None

Recommended prerequisites:

No knowledge beyond the (Fach-)Abitur is required. An intensive study of literature (see literature references below) is necessary.

Objectives:

1 Marketing and Sales:

The students will be able to

- define the nature, function and basic principles of marketing and sales.
- describe the strategic planning processes of a company in order to understand marketing (including sales) as a market driven philosophy.
- apply the marketing research process as a framework to analyze broad and task marketing environment of a company.
- understand the nature of positioning and differentiation.
- describe the concept and key elements of the marketing mix and their application.
- solve case studies on realistic marketing and sales problems.

Content:

1 Marketing and Sales:

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

2. 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

Literature:
Compulsory: • KOTLER, Philip, Kevin Lane KELLER and Alexander CHERNEV, 2022. *Marketing Management, Global Edition*. 16. edition. ISBN 978-1-292-40481-3 *Recommended:* • BECKER, Jochen, 2019. *Marketing-Konzeption: Grundlagen des zielstrategischen und operativen Marketing-Managements*. 11. edition. München: Vahlen. ISBN 3800657597, 978-3800657599 • KOTLER, Philip, Kevin Lane KELLER and Marc Oliver OPRESNIK, 2017. *Marketing-Management: Konzepte, Instrumente, Unternehmensfallstudien*. 15. edition. Hallbergmoos: Pearson. ISBN 3868942793; 978-3868942798

Methods & Instruments of Strategic Controlling

Module abbreviation:	BW_CF6

Curriculum:	**Programmes**
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2

Responsible for module:	Graap, Torsten
Lecturers:	Graap, Torsten
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 (BW_CF6)
Lecture types:	2.3: SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2.3-Methods & Instruments of Strategic Controlling: LN - written exam, 90 minutes (BW_CF6)

Additional Explanation:

2 Methods & Instruments of Strategic Controlling:

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.

Recommended prerequisites:

An intensive study of literature (see literature references below) is necessary.

Objectives:

2 Methods & Instruments of Strategic Controlling:

Students:

- 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 creativly develop their own strategic options for companies
- are capable to assess the application possibilities of the formentioned instruments in practice

The following AOL Learning Objectives are emphasized:

- Attitude of Responsibility
- Spirit of Creativity and Entrepreneurial Thinking
- Business Competence
- Application Strength

Content:

2 Methods & Instruments of Strategic Controlling:

- 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)

Content
• Effects of sustainability and digitalization on companies and their role in controlling

Literature:

Compulsory:

- DAVID, Fred R., 2022. *Strategic management: concepts and cases: a competitive advantage approach*. S. edition. Upper Saddle River: Pearson. ISBN 9781292441351

Recommended:

- BAUM, Heinz-Georg, Alfed COENENBERG and Thomas GÜNTHER, 2013. *Strategisches Controlling*. 5. edition. Stuttgart: Schäffer-Poeschel.
- ALTER, Roland, 2019. *Strategisches Controlling*. 3. edition. 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 (GBU-ML)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

7-Modern Leadership: mdlP - oral exam, 15 minutes (GBU-ML)

Additional Explanation:

None

Recommended prerequisites:

Basic knowledge in HR management and leadership.

Objectives:

7 Modern Leadership:

Students learn to

- understand the changing nature of leadership in the global new normal
- build, motivate and manage high-performance teams in a fast changing and increasingly digitized world
- correspondingly lead change and innovation in global organizations

Content:

7 Modern Leadership:

- 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:

Compulsory:

None

Recommended:

- 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

Portfolio Management in Research and Development

Module abbreviation:	LSM_PMRD

Curriculum:	**Programmes**
	Life Science Management (LSM-B) - SPO-Nr.: 2

Responsible for module:	Schuhmacher, Alexander
Lecturers:	Schuhmacher, 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:	2.10: Portfolio Management in Research and Development (LSM_PMRD)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2.10- Portfolio Management in Research and Development: LN - written exam, 90 minutes (LSM_PMRD)

Recommended prerequisites:

None

Objectives:

Subject Competence:
Upon successful completion of the module, students will learn to:
- Discuss the key principles and models of project portfolio management and life cycle management from both theoretical and practical perspectives.
- Establish the context of project management and project portfolio management.
- Apply the basic principles of risk management in the context of research and development of new drugs.
- Understand the relationship between project portfolio management and corporate strategy/management.

Methodological Competence:
- Students learn to conduct a SWOT analysis.
- Students can evaluate research projects qualitatively and quantitatively (including risk assessment).
- Students learn to perform a stakeholder analysis.

Personal/Self-Competence:
- Students develop a goal- and results-oriented approach to complex topics.
- Students enhance their analytical skills.
- Students learn to understand new topics and quickly grasp essential content.

Social Competence:
- Students develop an understanding of others' perspectives.
- Students realize that different viewpoints help to understand a topic more comprehensively.

Content:

The course covers the fundamentals of project and portfolio management in R&D through theory and case studies (e.g., pharma portfolio management). It revisits the basics of project and multi-project management, including scope, terms and definitions, project management concepts, processes, process groups (PMI), work breakdown structure (WBS), and team composition. Building on this, students learn key models for portfolio analysis, such as the Stage-Gate model, evaluation criteria, net present value (NPV), and various approaches to portfolio management, including scenarios, resource allocation, and portfolio optimization.

Literature:
Compulsory:

Literature:

Compulsory:
- Hinder M, Schuhmacher A, Goldhahn J, Hartl D (2022). Principles of Biomedical Science and Industries. In: Wiley-VCH. ISBN: 978-3527345717

Recommended
- S. Nokes and S. Kelly (2003). Guide to Project Management. FT Press
- Brown L. and Grundy T. (2011). Project Management in the Pharmaceutical Industry. Gower Verlag
- Kuster Jürg et al. (2018) Handbuch Projektmanagement. Springer
- ISO 21500. Guidance on project management. ISO 21500:2012
- Cohn, M. (2006). Agile estimating and planning. Upper Saddle River, NJ: Pearson Education, Inc.
- Project Management Institute (2008). A guide to the project management body of knowledge (PMBOK® Guide) (4th ed.). Newtown Square, PA: Project Management Institute.
- Schwaber, K. (2004). Agile project management with Scrum. Redmond, WA: Microsoft Press. Brown, Laure (2016) Project Management for the Pharmaceutical Industry. Gower Publishing

Product ideation

Module abbreviation:	FW_Product ideation

Curriculum:	**Programmes**
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2

Responsible for module:	Schneider, Reiner Albert
Lecturers:	Schneider, Reiner Albert
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:	2.5: Product ideation (FW_Product ideation)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2.5- Product ideation: LN - seminar paper (FW_Product ideation)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

Learnings
- are able to turn their ideas into real products and services through a repeatable process of ideation, prototyping, and iteration.
- are apt to uncover insight into their customers' wants and needs by using rough and rapid prototypes to gather feedback.
- are competent to run small experiments and learn from failure in a controlled environment to manage risk
- are aware of ways of creating a culture of experimentation on their team and expand their capacity for innovation

Content:

- New product development
- Innovation and Value proposition
- Agile way-of-working
- Design thinking and Prototyping

Literature:

Compulsory:
- EISENHARDT, K., MARTIN, J.A., 2000. Dynamic Capabilities: What are they? In: *Strategic Management Journal 21*, p.17.
- HENDERSON, R.M., CLARK, K.B., 1990. Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms. In: *Administrative Science Quarterly*, p.9-30.
- PELLEGRINELLI, S., 2011. What's in a name: Project or programme? In: *International Journal of Project Management, 29(2)*, p.40.

- SANCHEZ, R., MAHONEY, J., 1996. Modularity, Flexibility, and Knowledge Management in Product and Organization Design. In: *Strategic Management Journal*. (17), p.14.
- ZAHRA, S.A., GEORGE, G. Absorptive capacitiy: a review, reconceptualization, and extension. In: *Academy of Management Review*. **2002**(27/2), p.185-203.

Recommended:

None

Project Management

Module abbreviation:	LSM_PM

Curriculum:	**Programmes**
	Life Science Management (LSM-B) - SPO-Nr.: 1

Responsible for module:	Schuhmacher, Alexander
Lecturers:	Tissot-Daguette, Kathrin
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: Project Management (LSM_PM)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

1.13-Project Management: LN - presentation (15-30 min.) and written composition (10-15 pages) (LSM_PM)

Recommended prerequisites:

None

Objectives:

1 Project Management:

Students acquire the fundamentals of project management, focused on the application to the pharmaceutical/biotech industry.

They experience the importance of team building and teamwork, use creative methods and work independently on establishing a plan for their team's project of choice.

The course will be held in English and have a special focus on training oral presentation skills in the foreign language.

- Students are familiar with the basic vocabulary, standards and methods of program management, based on the PMI standard
- They are able to identify suitable methods for the project at hand and to translate them into practice

Content:

1 Project Management:

The content will be conveyed through a mixture of lectures, practical exercises and independent teamwork.

- Team building
- Leadership und communication
- Innovation und creative methods
- Storytelling und presentation skills
- Project management
    - Definitions und essential vocabulary
    - Project Domains: Planning, performance, measurement/control
    - Methods: from waterfall to hybrid & agile
    - Tools and best practice

Literature:

Compulsory:

- PROJECT MANAGEMENT INSTITUTE, 2021. *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. 7. edition. Pennsylvania, USA: Project Management Institute, Inc. ISBN 978-1-62825-664-2

Recommended:

None

Retail Lab: Consumer Projects and Project Management - **Master**

Module abbreviation:	RCM_CPPM

Curriculum:	**Programmes**
	Retail and 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 (RCM_CPPM)
Lecture types:	SC / E: seminar course with exercises

Studien- / Prüfungsleistungen:

1.1-Retail Lab: Consumer Projects and Project Management: Presentation, 15 minutes (RCM_CPPM)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

1 Retail Lab: Consumer Projects and Project Management:

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.

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.

Students know how to organize and manage a project. Students are prepared to handle specific assignments/projects at work.

The students are able to apply techniques and tools they have learned in international real-life projects.

Content:

1 Retail Lab: Consumer Projects and Project Management:

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:
Compulsory:
• PINTO, Jeffrey K., 2016. *Project management: achieving competitive advantage*. 4. edition. 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*. T. edition. Harlow, England: Pearson. ISBN 978-1-292-21467-2, 1-292-21467-8
Recommended:
• WANNENWETSCH, Helmut, 2004. *E-Supply-Chain-Management: Grundlagen, Strategien, Praxisanwendungen*. 2. edition. Wiesbaden: Gabler. ISBN 3-409-22015-1
• TAYUR, Sridhar, 2003. *Quantitative models for supply chain management*. 6. edition. Boston [u.a.]: Kluwer Acad. Publ. ISBN 0-7923-8344-3
• WILLIAMS, Luke, 2016. *Disrupt: Think the Unthinkable to Spark Transformation in Your Business*. 2. edition.

Retail Locations and International Retailing - Master

Module abbreviation:	RCM_RLIR

Curriculum:	**Programmes**
	Retail and Consumer Management (RCM-M) - SPO-Nr.: 2

Responsible for module:	Vogler, Thomas
Lecturers:	Vogler, Thomas
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:	2.3: Retail Locations and International Retailing (RCM_RLIR)
Lecture types:	SC / E: seminar course with exercises

Studien- / Prüfungsleistungen:

2.3-Retail Locations and International Retailing: mdlP - oral exam, 15-20 minutes (RCM_RLIR)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

2 Retail Locations and International Retailing:

The students shall be able to develop solutions in critical situations that can occur in international retailing - they shall get a feeling of the complexity of retailing esp. in different countries and under consideration of real estate issues.

They shall be able to understand what is essential in buying real estate with a retail store or buying a retail chain.

They should be able do develop their own opinion about future in retail - esp. brick and mortar retail.

They shall get an understanding of sustainability esp in real estate for retail.

They shall get acquainted with different methods of turnover prediction- their weaknesses and strength.

Content:

2 Retail Locations and International Retailing:

Nearly every lesson starts with a role play - students have to discuss and find a solution for a given situation that is real estate and retail related. The different solutions will be discussed.

Following issues will be presented and discussed:

Internationalisation and growth- implications for brick and mortar retailer

WalMart in Germany - why did they fail?

Real Estate in different legal systems

Case buying a retail store (real estate with store) with financial implications

Sustainability in retail- esp for Real Estate

Trade Areas

Different Turnover estimation methodes

Future of real estate in retail

Assett management in retail

Strategic support of retail by real estate

The students have to read beside the books down what will be supplied from my side in moodle.

Literature:

Compulsory:

- LEVY, Michael and Barton WEITZ. *Retailing Management - chapter 7 and 8*. 8. edition. ISBN 987-0-07-122098-9
- ZENTES, J., 2017. *Strategic Retail Management chapter 8*.
- BARKHAM, Richard, 2012. *Real estate and globalisation, chapter 1,2,.5*. Hoboken, N.J.: Wiley-Blackwell. ISBN 978-0-470-65597-9, 978-1-118-35167-3

Recommended:

- THRALL, Grant Ian. *Business Geography and new real estate market analysis chaper 1 and 7*.
- NOZEMAN, Ed F., 2014. *European metropolitan commercial real estate markets: Ed F. Nozeman ... (ed.)* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-3-642-37851-5, 978-3-642-37852-2. Available via: https://doi.org/10.1007/978-3-642-37852-2.
- ELLISON, Louise and Victoria EDWARDS, 2004. *Corporate Property management aligning real estate with business strategy*.
- SQUIRES, Graham. *Routledge Companion to Real Estate Development chapter 5, 8, 14, 15, 17, 18, 20*.
- TOSHIHARA, Ishikawa, 2016. *Dynamic Locational Phases of Economic Activity in the Globalized World Part 1*.

Strategic Management

Module abbreviation:	BW_StratM and BW_StratM-CS

Curriculum:	**Programmes**
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2

Responsible for module:	Wittmann, Robert
Lecturers:	Wittmann, Robert; Becker, Thomas; 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:	SU – lecture

Studien- / Prüfungsleistungen:

2.1.1-Strategic Management: schrP90 - written exam, 90 minutes (BW_StratM)

2.1.2-Strategic Management / Case Studies: LN - presentation (15-30 min.) and written composition (10-15 pages) (BW_StratM-CS)

Additional Explanation: Both subjects of the module must be attended and passed in order to receive ECTS!!!

Recommended prerequisites:

None

Objectives:

Strategic Management

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
- Introduction to Executive Management
- The tools of strategy analysis
- The analysis of competitive advantage
- Business strategies in different industry contexts
- Implementing and managing corporate strategies

- Value Based Management

Strategic Management / Case Studies

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

Literature:

Strategic Management

Compulsory:

- 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. 7. edition. 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. 5. edition. Wiesbaden: Gabler. ISBN 978-3-8349-1260-2
- MACHARZINA, Klaus and Joachim WOLF, 2008. Unternehmensführung: das internationale Managementwissen; Konzepte, Methoden, Praxis. 6. edition. Wiesbaden: Gabler. ISBN 978-3-8349-1119-3

Recommended:

- WELGE, Martin K. and Andreas AL-LAHAM, 2008. Strategisches Management: Grundlagen, Prozess, Implementierung. 5. edition. Wiesbaden: Gabler. ISBN 978-3-8349-0313-6, 3-8349-0313-2
- WHEELEN, 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 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

Strategic Management / Case Studies

Compulsory:

- 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*. 7. edition. 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*. 5. edition. Wiesbaden: Gabler. ISBN 978-3-8349-1260-2
- MACHARZINA, Klaus and Joachim WOLF, 2008. *Unternehmensführung: das internationale Managementwissen; Konzepte, Methoden, Praxis*. 6. edition. Wiesbaden: Gabler. ISBN 978-3-8349-1119-3
- WELGE, Martin K. and Andreas AL-LAHAM, 2008. *Strategisches Management: Grundlagen, Prozess, Implementierung*. 5. edition. Wiesbaden: Gabler. ISBN 978-3-8349-0313-6, 3-8349-0313-2
- WHEELEN, 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

Recommended:

None

Successful Management in a Global World

Module abbreviation:	FW_SMGW	
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:	2.5: Successful Management in a Global World (FW_SMGW)	
Lecture types:	SU/Ü - lecture with integrated exercises	

Studien- / Prüfungsleistungen:

2.5-Successful Management in a Global World: LN - seminar paper (FW_SMGW)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

2 Successful Management in a Global World:

- Students have cultural specific knowledge (East-West: USA-Europe-Asia) in relation to international management.
- are aware of communication-, management-, and leadership methods in different cultures.
- know about culture related techniques and behaviors.

Content:

2 Successful Management in a Global World:

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) will be made a topic. 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 are:

Organization, Planning, Human Resources, Leadership, and Controlling

These functions will be discussed in the context of cultural dimensions.

Firstly, the participants should 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.

Secondly, the participants 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.

Literature:

Compulsory:

- ENGELEN, Andreas and Eva THOLEN, 2014. *Interkulturelles Management*. 1. edition. Stuttgart: Schäffer-Poeschel. ISBN 978-3-7910-3248-1; 3-7910-3248-8

- TROMPENAARS, Fons. *Website* [online]. Available via: https://www.crossknowledge.com/de/faculty/fons-trompenaars-biografie-de
- HOFSTEDE, Geert. *Website* [online]. Available via: https://geerthofstede.com/

Recommended:

None

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:	2.6: Successful Negotiations in a Global World (SW_SNGW)	
Lecture types:	SU/Ü - lecture with integrated exercises	

Studien- / Prüfungsleistungen:

2.6-Successful Negotiations in a Global World: LN - seminar paper (SW_SNGW)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

2 Successful Negotiations in a Global World:

The students are able:

- 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:

2 Successful Negotiations in a Global World:

Economical facts, historical developments as well as current living conditions (East-West: in particular USA, Europe, Asia (Japan, Taiwan, China, Korea, Singapore).

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.

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.

Literature:

Compulsory:

- HECHT-EL MINSHAWI, Béatrice, 2008. Interkulturelle Kompetenz: Soft Skills für die internationale Zusammenarbeit; [wichtige Infos in Englisch]. 2. edition. Weinheim [u.a.]: Beltz. ISBN 978-3-407-36469-2
- TROMPENAARS, Fons. *Website* [online]. Available via: https://www.crossknowledge.com/de/faculty/fons-trompenaars-biografie-de
- HOFSTEDE, Geert. *Website* [online]. Available via: https://geerthofstede.com/
-

Recommended:

- MAHBUBANI, Kishore, 2009. *Can Asians think?* Singapore: Marshall Cavendish. ISBN 978-981-4276-01-6

Supply Chain Management

Module abbreviation:	BW_OM4	

Curriculum:	**Programmes**	
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2	

Responsible for module:	Sternbeck, Michael	
Lecturers:	Sternbeck, Michael	
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: Supply Chain Management (BW_OM4)	
Lecture types:	SU/Ü - lecture with integrated exercises	

Studien- / Prüfungsleistungen:

2.3-Supply Chain Management: LN - written exam, 90 minutes (BW_OM4)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

Students are familiar with the objectives, tasks, elements and challenges of supply chain management as well as relevant technologies and sustainability aspects. They know methods, instruments and measures for designing and optimising processes along the value chain in order to align them effectively, efficiently, robustly and responsibly.

Content:

The following content will be developed through seminar-style teaching, supplemented by group work and practical presentations and discussion:

- Supply chain design and strategic value chain management
- Planning and management of supply chains (strategic, tactical, operational; tools, methods)
- Identification of key sustainability aspects along the supply/value chain
- Processes and planning in and across value creation stages (inter-organisational planning, procurement, materials management, production, distribution; inventory management)
- Supply chain controlling (determination of strategic, tactical and operational parameters of supply chains)
- Practical examples and case studies for analysing and designing effective, efficient and sustainable supply chain management.

Literature:

Compulsory:
- SUCKY, Eric, 2021. *Supply Chain Management*. Stuttgart: Kohlhammer. ISBN 978-3-17-030979-1
- STADTLER, Hartmut, Christoph KILGER and Herbert MEYR, 2015. *Supply Chain Management and Advanced Planning*. 5. edition. Heidelberg Berlin: Springer.

Recommended:
None

Sustainability and CSR Management

Module abbreviation:	BW_HR4

Curriculum:	**Programmes**
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2

Responsible for module:	Lieske, Claudia
Lecturers:	Lieske, Claudia; Loza Adaui, 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 and CSR Management (BW_HR4)
Lecture types:	SU/Ü - lecture with integrated exercises (BW_HR4)

Studien- / Prüfungsleistungen:

2.3-Sustainability and CSR Management: LN - seminar paper (BW_HR4)

Additional Explanation:

2 Sustainability and CSR Management:

The final grade of the seminar consists of a presentation that includes a theoretical part and a case study presentation (35%), a seminar paper (35%), and feedback and evaluation of other participants' presentations (35%).

Recommended prerequisites:

None

Objectives:

2 Sustainability and CSR Management:

The students know about the current discussion on corporate social responsibility and sustainability management with a special focus on the role of human resource management. They have comprehensive knowledge about tools and instruments available for the effective management of people with dedicated attention to the challenges of shaping sustainable and socially responsible organizations.

Content:

2 Sustainability and CSR Management:

The course will examine business actions at the intersection between sustainability, CSR and human resource management.

- Students analyse the role of corporate sustainability and CSR for the human resource management practice.
- Students reflect and evaluate the different theoretical approaches that explain the interdependencies between sustainability, CSR, and human resource management.
- Students develop and produce a research paper that explains a particular issue or phenomenon of the discussion on sustainability, CSR, and human resource management.
- Based on a 360 degrees approach to skills development, students will be actively involved in the development and evaluation of presentation skills. They will provide feedback on their colleague's presentations after every session and will reflect and evaluate the outcome of their presentation using a self-assessment instrument.

Literature:

Compulsory:

- HASKI-LEVENTHAL, D., L. ROZA and S. BRAMMER, 2020. *Employee Engagement in Corporate Social Responsibility*. 1. edition. London: SAGE Publications. ISBN 978-1526496508
- RASCHE, A., M. MORSING and J. MOON, 2017. *Corporate Social Responsibility: Strategy, Communication, Governance*. 1. edition. ISBN 978-1107535398
- HAHN, R., 2022. *Sustainability Management: Global Perspectives on Concepts, Instruments, and Stakeholders*. F. edition. Fellbach: Rüdiger Hahn. ISBN 978-3982321103
- COHEN, E., 2010. *CSR for HR: A Necessary Partnership for Advancing Responsible Business Practices*. 1. edition. Sheeffield: Greenleaf Publishing. ISBN 978-1906093464
- MEISSNER, Ulrike Emma, 2022. *Nachhaltiges Human Resources Management*. Berlin: Peter Lang Gmbh, Internationaler Verlag Der Wissenschaften. ISBN 978-3-631-86728-0
- WIRTZ, Kim, 2021. *Nachhaltiges Personalmanagement – ein zukunftsfähiges Konzept oder konzeptlos in die Zukunft?* Augsburg, München: Rainer Hampp Verlag. ISBN 978-3-95710-385-7

Recommended:
- MOOSMAYER, D.C and others, 2020. *The Sage Handbook of Responsible Management Learning and Education*. 1. edition. ISBN 978-1526460707
- SCHNEIDER, A. and R. SCHMIDPETER, 2015. *Corporate Social Responsibility: Verantwortungsvolle Unternehmensführung in Theorie und Praxis*. S. edition. ISBN 978-3662434826
- AUST, Ina, 2014. *Sustainability and human resource management: developing sustainable business organizations* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 3-642-37523-5, 978-3-642-37524-8. Available via: https://doi.org/10.1007/978-3-642-37524-8.
- DOH, Jonathan P., STUMPF, Stephen A., c2005. *Handbook on responsible leadership and governance in global business* [online]. Cheltenham, U.K; Northampton, Mass: E. Elgar PDF e-Book. ISBN 978-1-84542-556-2. Available via: https://doi.org/10.4337/9781845425562.

Sustainability Reporting across Europe

Module abbreviation:	NW_SRaEur

Curriculum:	**Programmes**
	Betriebswirtschaft Bachelor (BW-B) - SPO-Nr.: 2

Responsible for module:	Loza Adaui, Cristian Rolando
Lecturers:	Loza Adaui, Cristian Rolando
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:	2.7: Sustainability Reporting across Europe (NW_SRaEur)
Lecture types:	SU/Ü - lecture with integrated exercises

Studien- / Prüfungsleistungen:

2.7-Sustainability Reporting across Europe: LN - seminar paper (NW_SRaEur)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

- Students learn the central theoretical foundations and methods of CSR and sustainability reporting.
- Students develop an understanding of the role of European institutional frameworks for CSR and sustainability reporting practices.
- Students develop a critical understanding of the different theories on CSR and sustainability reporting, as well as the subsequent implications for thinking and practice.
- Students understand the strategic role of CSR and sustainability reporting for the development of future-oriented business models.
- Students develop methodological skills for the implementation and design of CSR and sustainability reports in companies.
- Students develop methodological skills for the comparison, evaluation, and quality assurance of CSR and sustainability reporting in companies across various European countries.
- Students will develop methodological skills for task planning and teamwork.

Content:

- CSR and Sustainability Reporting in Changing Times.
- CSR and Sustainability Reporting as part of Sustainability Management.
- CSR and Sustainability Reporting Theories
- CSR and Sustainability Reporting Standards: European Sustainability Reporting Standards (ESRS)
- The Development of CSR and Sustainability Reporting in Europe.
- Research Methodologies for Comparing and Measuring the Quality of CSR and Sustainability Reporting.

Literature:

Compulsory:

- HERZIG, Christian, 2023. Reporting, Materiality and Corporate Sustainability. In: Andreas RASCHE, Ed.*Corporate Sustainability: Managing Responsible Business in a Globalised World*. Cambridge:

Cambridge University Press, S. 334-369.

- MION, Giorgio, LOZA ADAUI, Cristian R., 2019. Mandatory Nonfinancial Disclosure and Its Consequences on the Sustainability Reporting Quality of Italian and German Companies. In: *Sustainability*. **11**(17), p.1-28.

- FIFKA, Matthias S., 2014. CSR und Reporting: Nachhaltigkeits- und CSR-Berichterstattung verstehen und erfolgreich umsetzen. 1. edition. Berlin u.a.: Springer Gabler. ISBN 978-3-642-53892-6

Recommended:

- RIMMEL, Gunnar, Güler ARAS and Diogenis BABOUKARDOS, 2024. Research Handbook on Sustainability Reporting. Cheltenham, UK: Edward Elgar Publishing.

- MIO, Chiara, Marisa AGOSTINI and Francesco SCARA. Sustainability Reporting: Conception, International Approaches and Double Materiality in Action. Cham: Palgrave MacMillan.

Course Descriptions

Language Center

International Office

Winter term 2024/25

As per: 2024-08-06

This program and course description becomes effective on 01.10.2024. It supplements the program and examination regulations and secures the offerings in courses. Additionally, it contains detailed information about courses, contents, assessments and examinations.

6   Overview

Sprachenangebot des Sprachenzentrums

Fach	SWS	ECTS
German A1.1	4	5
German Culture and Cross Cultural Communication	4	5
Intercultural Business Communication	2	2.5
Intercultural Competence	2	2.5
Technical German 1	2	2.5
Technical German 2	2	2.5

7 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 (SZ_GERM_A1_1)
Lecture types:	: SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

German A1.1: LN - written exam, 90 minutes (SZ_GERM_A1_1)

Additional Explanation:

German A1.1:

LN - schriftliche Prüfung, 90 Minuten

Recommended prerequisites:

None

Objectives:

German A1.1:

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:

German A1.1:

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 menue. 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.

Literature:

Compulsory:

- EVANS, Sandra, Sabine GLAS-PETERS and Sabine SCHLÜTER, . *Menschen A1.1: Deutsch als Fremdsprache*. Ismaning: Hueber Verlag. ISBN 978-3-19-301901-1
- GLAS-PETERS, Sabine, Angela PUDE and Monika REIMANN, . *Arbeitsbuch: Menschen A 1.1, Deutsch als Fremdsprache*. Ismaning: Hueber. ISBN 978-3-19-311901-8

Recommended:

None

German Culture and Cross Cultural Communication

Modulkürzel:	SZ	SPO-Nummer:	

Zuordnung zum Curriculum:	**Studiengang u. -richtung**	**Art des Moduls**	**Studiensemester**
	Sprachenzentrum	Allgemeines Wahlfach	

Modulverantwortliche(r):	Reicherstorfer, Anja
Dozent(in):	Reicherstorfer, Anja
Sprache:	Englisch
Leistungspunkte / SWS:	5 ECTS / 4 SWS
Arbeitsaufwand:	Kontaktzeit: 47 h
	Web-based-training: 0 h
	Hausarbeiten/Leistungsnachweise: 0 h
	Prüfungsvorbereitung: 0 h
	Selbststudium: 78 h
	Gesamt: 125 h
Lehrveranstaltungen des Moduls:	German Culture and Cross Cultural Communication
Lehrformen des Moduls:	SU/Ü - seminaristischer Unterricht/Übung

Angestrebte Lernergebnisse:

German Culture:

The students:

- are familiar with the role of culture and cultural differences, especially between their home culture and German Culture.

Inhalt:

German Culture:

What is Culture?

What are Cultural Dimensions?

What is unique about German Culture?

Culture Shock

Migration, Immigration and Integration.

Studien- / Prüfungsleistungen:

LN - schriftliche Prüfung, 90 Minuten

Medienformen:

Diverse

Literatur:

Anmerkungen:

German Culture:

LN - schriftliche Prüfung, 90 min

This course is taught in English, an appropriate level of English is expected.

Intercultural Business Communication

Module abbreviation:	SZ_IBC

Curriculum:	**Programmes**
	Sprachenangebot des Sprachenzentrums (SZ-Sprachen)

Responsible for module:	Reicherstorfer, Anja
Lecturers:	Reicherstorfer, Anja
Language of instruction:	English
Credit points / SWS:	2.5 ECTS / 2 SWS
Workload:	Contact hours: 24 h Self-study: 39 h Total: 63 h
Subjects of the module:	Intercultural Business Communication (SZ_IBC)
Lecture types:	: SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

Intercultural Business Communication: LN - written exam, 90 minutes (SZ_IBC)
Additional Explanation:
None

Recommended prerequisites:

None

Objectives:

Intercultural Business Communication:

The students are familiar with the role of culture and cultural differences in general as well as of their effects on professional interaction.

They are aware of factors leading to intercultural misunderstandings and are able to consider methods of overcoming these problems in business communication.

Content:

Intercultural Business Communication:
- The importance communication in the context of culture
- Cultural Dimensions - Geert Hofstede, Edward Hall
- Selected business situations, such as
  o International Presentations
  o Negotiations across cultures
  o The role of international managers / managing international teams
- Comparing cultures, selected case studies

Literature:

Compulsory:
- MEYER, Erin, 2014. *The Culture Map*. New York,NY: Public Affairs Book. ISBN 978-1-61039-250-1
Recommended:
None

Intercultural Competence

Module abbreviation:	SZ_ICC

Curriculum:	**Programmes**
	Sprachenangebot des Sprachenzentrums (SZ-Sprachen)

Responsible for module:	McDonald, James
Lecturers:	McDonald, James
Language of instruction:	English
Credit points / SWS:	2.5 ECTS / 2 SWS
Workload:	Contact hours: 24 h
	Self-study: 39 h
	Total: 63 h
Subjects of the module:	Intercultural Competence (SZ_ICC)
Lecture types:	: SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

Intercultural Competence: schrP90 - written exam, 90 minutes (SZ_ICC)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

Intercultural Competence:

To familiarize students with the practical and theoretical fundamentals of intercultural communication with special emphasis on commercial application (i.e. business communication).

Content:

Intercultural Competence:

This course will be a proper seminar requiring intensive participation from all class members. Weekly in-class discussions will be based on assigned readings. Furthermore, students will be expected to engage one another in online communication via the MOODLE learning platform.

Literature:

Compulsory:

- An online reader containing all relevant English-language texts will be supplied at the beginning of the semester. The course reader will be posted online on the Moodle platform. Participants will therefore need access to the platform prior to attending the course. Additional texts will be added throughout the semester to supplement and illustrate various.

Recommended:

None

Technical German 1

Module abbreviation:	SZ_GERM_TECH

Curriculum:	**Programmes**
	Sprachenangebot des Sprachenzentrums (SZ-Sprachen)

Responsible for module:	Trufin, Ramona
Lecturers:	Trufin, Ramona
Language of instruction:	German
Credit points / SWS:	2.5 ECTS / 2 SWS
Workload:	Contact hours: 24 h
	Self-study: 39 h
	Total: 63 h
Subjects of the module:	Technical German 1 (SZ_GERM_TECH)
Lecture types:	: SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

Technical German 1: LN - written exam, 90 minutes (SZ_GERM_TECH)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

Technical German 1:

Die Studierenden:

- erhalten einen Eindruck von der Arbeit in deutschen Metall- und Elektroberufen in Industrie und Handwerk;
- können technische Sachverhalte verstehen und beschreiben;
- erwerben Strategien, die helfen, unbekannte Wörter zu verstehen, sowie Texten, Hörtexten und Videos/Filmen die wichtigen Informationen zu entnehmen;
- eignen sich fachliche Inhalte und entsprechenden Wortschatz aus unterschiedlichen Bereichen an (z.B. Ingenieurmathematik, Maschinenbau, Fahrzeugtechnik, Werkstofftechnik, Fertigungstechnik, Elektrotechnik, Informatik);
- entwickeln verschiedene Handlungskompetenzen: Sozialkompetenz (z.B. Teamfähigkeit, Zeitmanagement, Konfliktmanagement), Sachkompetenz (z.B. solides Fachwissen, marhematische und technische Kenntnisse), Methodenkompetenz (z.B. Auswertung von Information zur Lösung eines Problems, Problemlösungsfähigkeit) und Selbstkompetenz (z.B. Kommunikationsbereitschaft, eigene Stärken und Schwächen erkennen).

Content:

Technical German 1:

- Im Studium - Fachbegriffe und Texte aus Ingenieurmathematik, Fertigungstechnik, Werkstofftechnik, Elektrotechnik, Fahrzeugtechnik, Maschinenbau, Luftfahrttechnik, Informatik etc.
- Im Unternehmen - Forschung und Entwicklung, Produktion, Versuch, PQM, etc.
- Auf der Baustelle - Technische Anlagen und Werkzeuge, etc.

Literature:

Compulsory:

- BUHLMANN, Rosemarie and Anneliese FEARNS, 2013. *Technisches Deutsch für Ausbildung und Beruf:*

Lehr- und Arbeitsbuch. 1. edition. Haan-Gruiten: Verl. Europa-Lehrmittel Nourney, Vollmer. ISBN 978-3-8085-7309-9, 3-8085-7309-0

- STEINMETZ, Maria, DINTERA, Heiner, 2014. *Deutsch für Ingenieure: ein DaF-Lehrwerk für Studierende ingenieurwissenschaftlicher Fächer* [online]. Wiesbaden: Springer Fachmedien PDF e-Book. ISBN 978-3-658-03634-8, 978-3-658-03633-1. Available via: https://doi.org/10.1007/978-3-658-03634-8.

Recommended:

- KÄRCHNER-OBER, R., 2015. *Berufssprachführer - Deutsch für Ingenieure*. ISBN 9783195074759
- SCHROTH-WIECHERT, Sigrun, 2011. *Deutsch als Fremdsprache in den Ingenieurwissenschaften: Formulierungshilfen für schriftliche Arbeiten in Studium und Beruf*. 1. edition. Berlin: Cornelsen Verlag. ISBN 978-3-06-520665-5

Technical German 2

Module abbreviation:	SZ_GERM_TECH_2

Curriculum:	**Programmes**
	Sprachenangebot des Sprachenzentrums (SZ-Sprachen)

Responsible for module:	Trufin, Ramona
Lecturers:	Trufin, Ramona
Language of instruction:	German
Credit points / SWS:	2.5 ECTS / 2 SWS
Workload:	Contact hours: 24 h Self-study: 39 h Total: 63 h
Subjects of the module:	Technical German 2 (SZ_GERM_TECH_2)
Lecture types:	: SU/Ü - seminaristischer Unterricht/Übung

Studien- / Prüfungsleistungen:

Technical German 2: LN - presentation (10-15 min.) and written composition (8-10 pages) (SZ_GERM_TECH_2)

Additional Explanation:

None

Recommended prerequisites:

None

Objectives:

Technical German 2:

Die Studierenden:

- können grundlegende sprachliche Mittel und Strategien anwenden, um im Bereich Metall- und Elektroberufe, in Ferienjobs, Praktika, in der Ausbildung und im Betrieb mit Kollegen und Vorgesetzten sach- und fachgerecht zu kommunizieren;
- können Aufgaben aus der Praxis schnell und eigenverantwortlich lösen;
- können selbst Texte (z.B. Praktikums- und Arbeitsberichte, Bewerbungen) lesen und korrekt verfassen;
- können technische Hörtexte schnell verstehen und wiedergeben;
- können die Ergebnisse ihrer Projektarbeit / Dokumentation präsentieren.

Content:

Technical German 2:

- Technische Präsentationen;
- Kommunikation in technischen Berufen;
- Technische Texte lesen und schreiben - Tipps, Tricks und Strategien;
- "Hören"-Training: Technische Hörtexte;
- Lernen und Arbeiten als Ingenieur in Deutschland – Interkulturelle Tipps.

Literature:

Compulsory:

- BUHLMANN, Rosemarie and Anneliese FEARNS, 2013. *Technisches Deutsch für Ausbildung und Beruf: Lehr- und Arbeitsbuch*. 1. edition. Haan-Gruiten: Verl. Europa-Lehrmittel Nourney, Vollmer. ISBN 978-3-8085-7309-9, 3-8085-7309-0
- STEINMETZ, Maria, DINTERA, Heiner, 2014. *Deutsch für Ingenieure: ein DaF-Lehrwerk für Studierende*

ingenieurwissenschaftlicher Fächer [online]. Wiesbaden: Springer Fachmedien PDF e-Book. ISBN 978-3-658-03634-8, 978-3-658-03633-1. Available via: https://doi.org/10.1007/978-3-658-03634-8.

Recommended:

- FEARNS, Anneliese, 2010. *Kommunizieren in technischen Berufen* . Haan-Gruiten: Verlag Europa-Lehrmittel.
- KÄRCHNER-OBER, R., 2015. *Berufssprachführer - Deutsch für Ingenieure: Griechisch, Spanisch, Polnisch, Rumänisch*. ISBN 9783195074759
- SCHROTH-WIECHERT, Sigrun, 2011. *Deutsch als Fremdsprache in den Ingenieurwissenschaften: Formulierungshilfen für schriftliche Arbeiten in Studium und Beruf*. 1. edition. Berlin: Cornelsen Verlag. ISBN 978-3-06-520665-5