UAS Technikum Wien

COURSE GUIDE WS2025

COURSES OFFERED IN ENGLISH

→

Please note:
Incoming students have the possibility to combine courses from different study programs. The number of places available for Incoming students in each course may vary or be limited to a certain number.
Please be aware, that incoming students are obliged to generate at least 9 ECTS from the Campus International.

At the beginning of each semester an Orientation Week is held for all Incoming students as well as for all Double Degree students.
The Orientation Week takes usually place in the 2nd week of September resp. 2nd week of February.
Please take into consideration that this course guide may be subject to change!
Last update: 27.03.25

OVERVIEW OF COURSES OFFERED ENTIRELY IN ENGLISH

Inhaltsverzeichnis

GLOSSARY AND ABBREVIATIONS

Term	Abbreviation	Description
Laboratory	LAB	Application and practical exercises in small groups.
Seminar	SE	High extent of interactivity in teaching and by a sequence of theoretical inputs, case studies, exercises and discussions in small groups.
Integrated Teaching	ILV	Instruction is given by a sequence of theoretical teaching and practical exercises in (small) groups.
Distance Learning	FUV/FL/DL	The courses are devided into the on-campus phase and distance/online learning. During the on-campus phase the presence of the students is obligatory. During these phase the students have the introduction courses, attend the examinations or give their presentations in front of the class. During the online-phase the students have to work on the course contents via moodle courses, where they have to hand in assignments, take part in forum discussions and/or read study letters and literature. During the online-phase the students do not have to be presence at the university.
Lecture	VO	Mediation of new knowledge by the means of frontal teaching.
Exercise	UE	Reduced transfer of new knowledge and practical strengthening in (small) groups.

Study Program	Abbreviation (in German)
Bachelor	
Biomedical Engineering	BBE
Renewable Energies	BEE
Sustainable Environmental and Bioprocess Engineering	BUB
Electronic Engineering	BEL
Information and Communication Systems and Services	BIC
Computer Science	BIF
Mechanical Engineering	BMB
Mechatronics/Robotics	BMR
Human Factors and Sports	BHF
International Business Engineering	BIW

Business Informatics	BWI
Master	
Medical Engineering & eHealth	MME
Data Science	MDS
AI Engineering	MAI
Renewable Urban Energy Systems	MEE
Embedded Systems	MES
Health Care and Rehabilitation Technology	MGR
Power Electronics	MLE
Industrial Engineering & Business	MIB
Mechanical Engineering	MMB
Robotics Engineering	MRE
Software Engineering	MSE
Quantum Engineering	MQE
Sports Equipment Technology	MST
Tissues Engineering and Regenerative Medicine	MTE
Internet of Things and Smart Systems	MIO
Innovation and Technology Management	MTM
Information Systems Management	MWI

CAMPUS INTERNATIONAL

Campus International

CI_Traffic Safety Culture and Mobility

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	This integrated course provides insights to theoretical background and practical issues of national, regional and local aspects of traffic safety culture and mobility in the Vienna region as well as human factors in transportation and mobility.
Teaching methods	Mandatory readings, individual investigation, presentations and group discussions in plenum and breakout sessions. Some frontal teaching.
Learning outcome	After passing this course successfully students are able to ... - explain the concept of traffic safety culture and practically apply it to plan their mobility, safely and efficiently travel to all relevant points of interest - understand local particularities and consider them for a safe movement during their stay in Vienna and beyond - gain basic understanding of important psychological concepts relevant for research of human factors in mobility (technology acceptance, emotions & aggression, perception). Those concepts can be operationalized and measured, thus considered for the students' own research
Course contents	- Applied: The concept of traffic safety culture and its application to any place in the world, in particular to the Vienna region. Planning trips using all modes from the most individual (bicycle, e-scooter) to the to the most public means of transport (bus, underground, train). Practical aspects from buying tickets to some of the strangest traffic rules in Austria. Acquisition of a driving license as well as use of shared vehicles. Points of interest from administration to sports.

	Theory and Research: •Elaboration of different concepts of traffic safety culture and their application in different professional contexts. Operationalization and measurement of traffic safety culture as well as intervention strategies on different levels (example of local road safety culture). •Human factors in the context of increasing vehicle automation: cooperation between driver and vehicle, new 'driving' skills (monitoring, vigilance), driver training of the future, ethical dilemmas •Acceptance of new technology: different types of adoptions, influencing factors and how to measure acceptance •Aggression in traffic: why can traffic be so hostile? Genesis, contributing and mitigating factors
Prerequisites	None
Assessment Methods	- Reports on mandatory readings (30%) - active participation (30%) - Exam
Recommended Reading and Material	- Ward, N. J., Watson, B., & Fleming-Vogl, K. (Eds.). (2019). Traffic Safety Culture: Definition, Foundation, and Application. Emerald Group Publishing. - Shinar, D. (Ed.). (2017). Traffic safety and human behavior. Emerald Group Publishing. - Journal Transportation Research Part F - Journal of Transportation and Health
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

Service and object-oriented Algorithms in Robotics

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	The course discusses important concepts of robot control in the context of modern data-driven robotics. Thus, different

	methodologies from robotics and data-science are are taught and utilised using Python and the robot operating system (ROS).
Teaching methods	This course is based on theory and exercises with mobile robot simulations/ robots. - Lecture (theory, methods, math and algorithms) - Exercises in small groups: problem solving with robot simulation/ real robots
Learning outcome	After passing this course successfully students are able to ... - explain components and operating modes of robots, - define and differentiate between navigation with plans, localisation and trajectory planning, - identify required robot system components based on the system's desired use case and level of autonomy, - create ROS launchfiles and interface with ROS using Python and Jupyter notebooks, - implement pipelines for sensor data processing, and - explain and visualise various data types/structures required in robotics applications.
Course contents	- Introduction to important concepts in robotics and ROS - Sensor-based robot control - Mobile robot simulation - Programming and software documentation (Python and Jupyter notebooks)
Prerequisites	Mandatory: - Sensor technology - Basic understanding of programming, in particular in Python or C
Assessment Methods	- 70% Group project with presentation - 30% Exercises
Recommended Reading and Material	- http://wiki.ros.org/ROS/Tutorials - C. M. Bishop, Machine Learning and Pattern Recognition, 2006 - S. Russell and P. Norvig, Artificial intelligence: a modern approach, 1995
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	-

ASSIST HEIDI Designing and implementing Assistive Tools for people with disabilities

Degree programme	ECI

Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	This course brings students and people with disabilities (HEIDI – Human being with disability) together, to design and prototype an individual assistive technology solution for them. Students will learn the basics about disability, existing assistive tools, rapid prototyping and microcontrollers and will have access to materials, tools and equipment (e.g. 3D printer etc.). The Smart Living Lab of the UAS Technikum Wien (https://youtu.be/qv6cvPn4fNU) provide the perfect environment for the participants. This is the best opportunity to get to know people with disabilities, to contribute, develop and implement your own ideas.The course methodology and contents will be similar to the ASSIST HEIDI summer school 2022. Link: https://www.technikum-wien.at/en/course-assist-heidi/
Teaching methods	Co-Design, Problem-based learning
Learning outcome	After passing this course successfully students are able to ... - understand daily challenges of people with disabilities - understand and apply the principles of co-design - understand types and causes of disabilities - know the current technical aids to support people with disabilities and to be able to select suitable technologies for certain applications - design and implement assistive prototypes using rapid prototyping, microcontrollers, or computer vision / ML
Course contents	- At the beginning of the course the students will be introduced to people with disabilities and will interview them to understand their daily challenges and find inspiration for project work. After the project selection the students will form groups of 4-6 persons and collaboratively design and implement a project idea supervised by the lecturers. Finally, the project results must be presented and will be evaluated by the HEIDIs and lecturers. - In parallel, several topics will be covered including small exercises: □Physiological basics, Types and causes of disabilities □Assistive tools □Rapid Prototyping □Computer vision + ML with python □Arduino microcontroller - In week 1, the classes will be on Wednesday and Thursday 15:15 –

	17:40. Starting with week 2, the classes will be held weekly on Thursday 16:10-17:40 on campus. In parallel, regular sessions are provided for project supervision on Wednesday 16:10-17:40 (bi-weekly).
Prerequisites	Programming, English
Assessment Methods	
Recommended Reading and Material	- Author: Dr. Wolfgang L. Zagler, Title: Rehabilitationstechnik, Date: March 1, 2008, Location: Vienna, Austria, Book URL: https://studyathome.technikum-wien.at:8092/
Attendance	Attendance is mandatory in classes on campus.
Comments	

International Marketing

Degree programme	ECI
Semester	1
Course methods	SO
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	The decision whether to internationalize: Understanding internationalization motives, barriers and risks; value net analysis of international competitiveness; Deciding which markets to enter: Global market research; market selection process; environmental analysis; Market entry strategy: transaction cost approach; export, intermediate, hierarchical entry modes; international buyer-seller relation; Designing of the global Marketing program: Green marketing strategies; cross boarder pricing challenges, channels decisions, international advertising strategies; Global Brand Management: customer based brand equity, brand association map, brand extension and diversification in a global context brand elements;
Teaching methods	Self-study, lecture, distance learning, case studies, group projects
Learning outcome	After passing this course successfully students are able to ... - discuss motives and triggers why firms go international - evaluate the factors influencing a firm's international

	competitiveness - define international market selection and identify the problems related with it - evaluate the factors to consider when choosing a market entry strategy - design global marketing programs - contribute to strategic marketing decisions - understand and contribute to marketing mix decisions
Course contents	- Internationalization process - Market segmentation - Creating competitive advantage - Global marketing communication - Market selection process - Brand building - Marketing Mix decisions
Prerequisites	none
Assessment Methods	- Written examination (70%) - Group Assingment (30%)
Recommended Reading and Material	- Global Marketing, Hollensen, 2016 - International Marketing, Czinkota , Ronkainen 2012 - Strategic Brand Management, Keller 2013
Attendance	Attendance is compulsory.
Comments	Detailed information regarding the course is provided via Moodle.

Mobile Robotics

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	The course provides an introduction to the basics in mobile robotics with regard to essential mobile robot components. Students achieve a basic understanding of methods to control mobile robots by implementing behaviours as well as methods for direct sensor-actor coupling.

Teaching methods	This course is based on theory and practical exercises/projects using simulation of mobile robots. The first classes are supported by a theory lecture (theory, methods, mathematics and algorithms) and guided exercises before students solve project tasks in small groups (solving various problems arising in robot control in simulation/on real robots).
Learning outcome	After passing this course successfully students are able to ... - explain basic methods of control theory required for mobile robots, - visualise and interpret a mobile robot's sensor readings using the robot operating system, - control mobile robots by applying behaviour methods for direct sensor-actor coupling, - apply basic programming knowledge in Python to examine and model behaviour of a mobile robot's control system.
Course contents	- Introduction to important concepts in robotics and ROS - Coordinate systems and transformations in robotics - Mobile robot kinematics - Essential control theory
Prerequisites	Mandatory: Sensor technology and basic understanding of programming, in particular in Python or C
Assessment Methods	- 70% Group project with presentation - 30% Exercises
Recommended Reading and Material	- http://wiki.ros.org/ROS/Tutorials - R. Siegwart and I.R. Nourbakhsh and D. Scaramuzza, Introduction to autonomous mobile robots, 2011 - C. M. Bishop, Machine Learning and Pattern Recognition, 2006
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the semester project.
Comments	This course requires a (reasonably) powerful computer:- min i5 (7th gen.)- 8GB RAM (Ubuntu) | 16GB RAM (Windows)

Data Ethics & Open Data

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English

ECTS Credits	6.00
Incoming places	Limited
Course description	Open data is accessible public data that people, companies and organisations can use and process. The benefit of Open Data is not only the publication itself, but especially its duplication and reuse as new applications and solutions can increase transparency, promote innovation and encourage community engagement. The extensive use of increasingly more data in general also requires the consideration of complex moral and ethical subjects related to data to support good solutions and responsible handling. The course will be divided into two subject areas: Lectures on Data Ethics will provide the opportunity to learn about the ethical impacts of data and related topics (privacy, transparency, surveillance etc.). In lectures on Open Data students will learn about Open Data from a technical viewpoint and work on an Open Data application.
Teaching methods	The course consists of - lectures combined with discussions - project work and exercises
Learning outcome	After passing this course successfully students are able to ... - analyse and work with Open Data - determine different fields of Open Data applications - assess the quality of different Open Data sources - valuate the importance of responsible handling of data in different areas of application - discuss domain-related data ethics - analyse and describe the challenges and risks of an intelligent machine learning system (AI)
Course contents	- Open Data applications in different fields: Healthcare, finance, Smart Cities etc. - Open Data formats - Open Data policies - Project: analysing and processing open data - Data Ethics - Data Privacy, Transparency
Prerequisites	Basic Knowledge in Web Technologies, Database Systems, and Data Management
Assessment Methods	- Participation in discussions and presentation (Data Ethics) - Project results and project presentation (Open Data)
Recommended Reading	- Ethics Advisory Group (2018): Ethics Advisory Group Report 2018

and Material	- European Union (2017): Open Data Maturity in Europe 2017 - Specific papers related to domains - Open data Web sites and catalogues (e.g. https://open.wien.gv.at)
Attendance	Attendance is mandatory
Comments	Course Details will be provided in Moodle.

Building and Solar Energy

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	Design of a solar system for a housing complex including technical parameter, contribution to the local electricity system including heating and mobility needs; economic calculation, ecologic impact.
Teaching methods	Project-Based Learning method. Combined with lectures and practical teaching on the remote laboratories. Supported by virtual learning environment and simulation.
Learning outcome	After passing this course successfully students are able to ... - Design preliminary concepts and design of energy efficient building supported by solar energy - Simulation of a solar energy system - Possibilities of building integrated photovoltaics and construction design - Overview of the market, drivers, stakeholders for integration of affordable renewable energy systems
Course contents	- Energy characterization and energy planning of solar building - Designing a building-integrated photovoltaic installation by software tools - Measurement and analysis of solar systems in the lab - Best practice of solar design (Excursion) - Overview of the market, legislative and drivers for solar energy and buildings
Prerequisites	Basic knowledge at least in one or two of the following topics: - Building construction - Solar energy system - Energy planning of

	buildings
Assessment Methods	- Lecture notes - Grading of practical session - Project reports
Recommended Reading and Material	- Cost Optimal and Nearly Zero-Energy Buildings (nZEB) Definitions, Calculation Principles and Case Studies, Editors: Kurnitski, Jarek (Ed.) - Designing with Solar Power: Source book for Building Integrated Photovoltaics. D. Prassad, M. Snow Routledge - Modeling, Design, and Optimization of Net-Zero Energy Buildings Athienitis (Ed.), W.O'Brien (Ed.), ISBN: 978-3-433-03083-7, February 2015 - Building integrated photovoltaics: A handbook S. Roberts and N. Guariento, Editors: Springer
Attendance	Attendance is mandatory in this course, only 20% of absence is accepted.
Comments	Mixed: Incoming students in collaboration with FHTW Master students - Project-based learning on real city development project from city of Vienna (MA20) or the city of Korneuburg - Integration in the curricula of the Master program of renewable energy

CI_Renewable Energy Laboratory

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Experimental setup of different means of measuring methods to evaluate the performance of renewable energy technologies and systems.
Teaching methods	Laboratory exercises in small groups of typically 8-12 students
Learning outcome	After passing this course successfully students are able to ... - measure and analyze the energetic performance of components of energy conversion systems and measure and interpret the power quality of energy networks

	- measure and analyze the energetic performance of heat pumps, - measure and analyze the energetic performance of thermal solar plants and photovoltaic plants, - measure certain parameters of ventilation and hydraulic systems and interpret it.
Course contents	- Measurements and analysis of the energetic performance of energy conversion systems, - analysis of the power quality of electrical networks, - measurement and analysis of the efficiency of heat pump systems, - measurements and performance tests of solar thermal and photovoltaic plants, - performance tests of ventilation and hydraulic systems
Prerequisites	Basics in: - Electrical machines - Mechanical engineering - Thermodynamics - Instrumentation
Assessment Methods	- Laboratory notes - Laboratory reports - Grading of practical session - Laboratory reports
Recommended Reading and Material	- Scripts of the lecturers
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_German Language & Austrian Culture A2

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Based on the A1 course we train frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment).The course will teach frequently used expressions related to very basic personal and family information, shopping, local geography,

	employment.indefinite pronouns
Teaching methods	group work, role play, text production,homework
Learning outcome	After passing this course successfully students are able to ... - understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need
Course contents	- Grammar:regular and irregular verbs in Perfect, prepositions with Akkusativ+Dativ, separable verbs - Topics: Living together, Looking for an apartment, Furniture, clothes, Sights, Arts, Basic information about Austrian culture
Prerequisites	A1
Assessment Methods	
Recommended Reading and Material	- PANORAMA, Deutsch als Fremdsprache A21, Kursbuch,Cornelsen Verlag; ISBN 978-3-06-120488-4 (also available as E-Book)/ PANORAMA Übungsbuch A2.1; ISBN 978-3-06-120604-8
Attendance	
Comments	

CI_German Language & Austrian Culture A1

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Starting from a very basic level of German (A1 of the Common European Framework of Reference for Languages), we aim at developing students for situations required for personal and social interaction in Austria on a basic level. The focus of the course is the development of oral communication skills within an intercultural context.

Teaching methods	discussions, integrative grammer work, role games, songs, group work and presentations
Learning outcome	After passing this course successfully students are able to ... - ask questions about personal details - talk about themselves and others in terms of hobbies, preferences, dislikes - understand and write short e-mails, using an appropriate level of formality - understand and formulate simple questions and orders - understand and use numbers in various contexts as well as to ask for prices, such as in the furniture store, in the restaurant, at the Christmas market - give the time of day and make appointments - understand and use the phrases required for shopping and eating out as well in daily situations - talk about living circumstances as well as the weather and ask questions - talk and write about the past
Course contents	- personal topics - vocabulary and situations in terms of eating and drinking, living circumstances - weather - oral and written situations in the past (past perfect tense) - integrative grammar: articles in nominative and accusative, possessive pronouns in nominative and accusative, past perfect tense, prepositions, imperative, modal verbs
Prerequisites	Basic knowledge in German language (GERS A1) such as ABC, numbers, conjugation of the verbs, articles, forms of negation, basic vocabulary is advantageous
Assessment Methods	- 20% personal language development; 30% tests during the semester; 50% final exam (written exam and presentation)
Recommended Reading and Material	- Scriptum and online-exercices
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_Building Climate Engineering

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Theoretical and practical basics of Building Energy Design: energy efficient constructions, building physics, heating, ventilation and air conditioning of energy efficient buildings in Austria and internationally.
Teaching methods	Lectures combined with practical teaching on the construction site of an energy efficient building.
Learning outcome	After passing this course successfully students are able to ... - analyze different building construction components, facades and window concerning their energy efficiency, comfort and building physics, - design preliminary concepts of energy efficient projects, - overview possibilities of ventilation, heating and cooling, - compare different construction techniques concerning energy efficiency, building quality and comfort, especially related to their home country.
Course contents	- Basics of building physics, heat, humidity and sound protection - Building construction components from the view point of building physics and energy efficiency, comparison on international basis - Heating, cooling and ventilation possibilities, - Energy benchmark levels, calculating of the energy demand of buildings
Prerequisites	Basic knowledge at least in one or two of the following topics: - Building construction- Building physics - Heating, ventilation and air conditioning - Energy planning of buildings
Assessment Methods	- Combined written and oral exam, written exam in 2-3 examples 40% Cooperation, attendance 20% - Project including energy layout and a short planning example of heating, ventilation and/or cooling 40%
Recommended Reading and Material	- Gerhard Hausladen, Saldanha, Liedl, 2013: Climate Skin Building Skin Concepts that can do more with less energy, ISBN978-3-0346-0727-8, Birkhäuser Verlag Basel

Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_Scientific Writing

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This hands-on-course dives deep into the praxis of scientific writing. Theory and basics of scientific writing are subjects of online learning, while the meetings are used to practice, analyse und discuss your own scientific writing.
Teaching methods	Exercises, peer-learning, talks, discussions, online-tasks
Learning outcome	After passing this course successfully students are able to ... - Define, describe, identify and evaluate academic resources - Describe and apply the common structure of a scientific paper - Discuss the different kinds of research questions and apply them to their field or research - Describe and discuss the common structure of a Bachelor's Thesis or Master's thesis - Write text according to common standards of academic writing
Course contents	- How is academic writing done? Where to find resources and references? What kind of scientific writing is adequate for which purpose? How are scientific papers structured? How to cite correctly? Which style of language is adequate?
Prerequisites	Basic knowledge of scientific keyterms and principles.
Assessment Methods	- Course immanent assessment method and end exam
Recommended Reading and Material	- Leedy, Ormrod: Practical Research. Planning and Design. Pearson - Skern: Writing Scientific English. Facultas wuv UTB
Attendance	Attendance is partly mandatory in this course. You can attend every class, and should at least participate in two sessions (50%) after the

Kick-off.

Comments

CI_Audio Engineering

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	This integrated course provides students the opportunity to familiarise themselves with the basics of acoustics and audio engineering, including perception of sound, microphones, amplifiers, loudspeakers, audio processing, etc.
Teaching methods	The Lecturer will explain some basic concepts. The students will compete tasks in the computer using Matlab.
Learning outcome	After passing this course successfully students are able to ... - Understand the signal chain in a typical audio application, and be able to recognise and avoid distortions in all stages - understand how humans perceive sound, - record sounds using the appropriate equipment, - measure different attributes of sound and understand how they correlate to human perception, - analyse and interpret recorded sounds - synthesise sounds with specific attributes - perform audio processing on recordings - understand how audio compression works
Course contents	- Sound and sound attributes - Human perception of sound - Signal chain in audio engineering - Microphones and amplifiers - Analog vs digital signals - Fourier Analysis, Spectrum, Spectrogram - Synthesis of sounds - Filters - Audio compression

	- Lourspeakers09
Prerequisites	Basic programming skills. Matlab knowledge advantageous.
Assessment Methods	- The students will be assessed according to how far they completed the task at hand
Recommended Reading and Material	- Script provided by the lecturer
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_German Language & Austrian Culture B2

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Repetition, perfection and exercises of relevant grammatical structures • Vocabulary and useful phrases for B2 • Economy / career / work • New technology • Modern life / society
Teaching methods	Normal class with presence (15 UE): Discussions, work in large and small groups and presentation of your results you have prepared in form of a short text. AND E-learning with Moodle (15 UE): Single work with deadline for interim reports, exercises on reading, grammatical issues and vocabulary, writing 3 short texts (400 words each) and revision of the 3 texts.
Learning outcome	After passing this course successfully students are able to ... - understand grammatically complex texts which are rich in vocabulary on the level B2 - write a summary and comment the main topics of a text. Furthermore you have developed and enlarged your knowledge of German for the purpose of your studies - You have improved and clarified your writing skills as well as you can refer to phrases of argumentation.

	- describe and comment graphics and you can take a critical point of view in the context of a text. - write a request, a letter of complaint with the appropriate register
Course contents	- Reading of press articles and exercises in global and close reading as well as training of vocabulary and grammar - Writing summaries and expressing your point of view with the right expressions - Expressing advantages or disadvantages - Writing a letter of complaint or a request with the right expressions - Reporting about texts, describing and commenting graphics in the context of an article - Making an interview in the context of your studies and writing about your learning outcome
Prerequisites	Only for students with a good knowledge of German who are interested in improving their writing skills
Assessment Methods	- 1) 3 texts Option A Writing a summary and a comment on 3 long newspaper articles (1 with graphics) in the amount of about 400 words. OR Option B: Writing a summary and comment on 2 long newspaper articles (1 with graphics) in the amount of about 400 words and make a study-specific interview with a person of your interest, write a transcription/summary and reflect about your learning outcome. (50 points) - 2) Exercises on Moodle (25 points) - 3) Active participation (25 points)
Recommended Reading and Material	- Texts and exercises on Moodle and handouts of the regular class.
Attendance	Compulsary
Comments	

CI_Electronic Laboratory

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	This integrated course provides students the opportunity to calculate and build electronic circuits, as well as measuring their characteristics with modern measuring devices.
Teaching methods	The Lecturer will explain briefly the basic concepts students need to know to perform the experiment at hand. The students will work in groups to perform the experiment. The Lecturer will be available to assist the students in building and measuring their experiment, as well as to clarify any questions and solve any problems that may arise in the process.
Learning outcome	After passing this course successfully students are able to ... - measure voltages and currents with a DMM and oscilloscope correctly - produce signals with the Function Generator - calculate electronic circuits, build them and measure their outputs and characteristics - measure the output of circuits involving resistors, capacitors, diodes and OpAmps with the oscilloscope
Course contents	- Oscilloscope and Function Generator - Kirchhoff laws - Diode and Zener Diode - DC Power supply design and implementation - OpAmp circuits - RC Circuit: DC and AC analysis - Transistor Amplifiers - Project: Audio Equaliser
Prerequisites	Students should have basic knowledge of electronics and electronic circuits.
Assessment Methods	- The students will be assessed according to how far they completed the experiment at hand.
Recommended Reading and Material	- Maxfield et al., “Electrical Engineering know it all”, Newnes & Elsevier, 2008. - Scripts and materials provided by the lecturer.
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_Empowering Intercultural Teams for Success: Theory - Tactics – Solutions

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description

Simply, the purpose of this course is to help you enhance your employability and further the development of your career prospects. In an increasingly inter-cultural and dynamic world what will be the skills that stand out to attract employers? Intercultural awareness, the ability to work in multi-cultural teams, the ability to demonstrate awareness and agility and the ability to work in an English environment would be some of the important ones that might occur to you. And it is exactly these skills that this interactive and compelling course will help you develop. The course will mix intercultural theory (such as Hofstede's dimensions) and that of building resilient and functional teams (Bruce Tuckman) with a highly interactive practical project where course participants work together to solve a flash business challenge. The course will also enable you to meet many international students from a great variety of nationalities!Some testimonials from students who took the course in the Winter Semester:'In this course you get the perfect combination of theoretical inputs and practical work in the topic of Business in different cultures and countries. At the same time you get to meet students from around the world."The ECI Course gave me an insight into the world of intercultural team work that is very valuable, also for general management. The culturally diverse team itself and the lecturers created a good working environment.''As a student in the ECI Course, I've been able to gain valuable insights into intercultural team dynamics and expand my management skills while working with a diverse team and learning from expert instructors.'

Teaching methods

Theoretical input, group workshops, teamwork, group discussions, independent research, participant preparation of written documents.

Learning outcome

After passing this course successfully students are able to ...
- question their culturally formed stereotypes and prejudices;
- reflect on different strategies for dealing successfully with cultural differences;
- apply strategies to overcome problems related to intercultural

	differences; - work successfully in an English as a Lingua Franca environment; - cooperate effectively in intercultural teams to overcome and solve cultural problems and issues.
Course contents	- Attributes of a successful intercultural team participant/leader; - Hofstede's cultural dimensions; - Techniques for efficient communication in English as a Lingua Franca; - Strategies for working successfully in an intercultural team; - Problem based intercultural workshop
Prerequisites	B2 English level
Assessment Methods	- 25% student presentation - 50% successful completion of workshop - 25% final written task
Recommended Reading and Material	- Script
Attendance	75% mandatory
Comments	

BIP-Cooperative International Student Project (CIP)

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	The main focus of the specialization ‚Cooperative International Project-Smart Cities' follows the integrated design of urban projects under consideration of technological options (energy, buildings, networks), design options (architecture in urban areas) and user behaviour (diversity). Through the integration of interdisciplinary and international teams the project gains additional benefit. Compared to the specialisation of the 4th semester technological options, geographic area and user behaviour get complexer.
Teaching methods	project work with international teams

Learning outcome	After passing this course successfully students are able to ... - solve integrated planning, design, construction and development procedures in the international context of a smart city - discuss and evaluate the interdisciplinary aspects of energy supply and demand, architecture and city planning for building complexes - analyse and integrate gender and diversity aspects in the international context of a smart city project - integrate measures and data analysis of international reference projects in the own project - formulate and state a problem of the respective discipline and write a scientific bachelor thesis adhering to a given template - explain and present the contents and results of their own scientific publications and those of others
Course contents	- International Team work of an integrated planning process of a large SMC project, for instance a district in urban areas. Consequent procedure of characteristic project phases, requirement specifications, project plan, design concepts, variants, documentation and presentation. Integration of diversity aspects in the smart city context. Usage of complex simulation software. Contact with regional, urban administration officials.
Prerequisites	Basics in at least two sectors: building construction, electrical and/or mechanical installations, energy design and solar architecture
Assessment Methods	- Course immanent assessment method with a final presentation in front of an international commission
Recommended Reading and Material	- Transform, Transformation Agenda for Low Carbon Cities, 2013, http://urbantransform.eu
Attendance	Attendance ist mandatory
Comments	this project will be realised in cooperation of international University teams

CI_German Language & Austrian Culture B1

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	This integrated course provides the linguistic skills to deal with most situations likely to arise whilst you are staying in Austria. You will be prepared to enter into conversation on topics that are familiar, of personal interest or pertinent to everyday life (e.g. family, hobbies, work, travel and current events).
Teaching methods	Group work, role plays, text production, excursion, audio- and video files, authentic texts
Learning outcome	After passing this course successfully students are able to ... - understand the main points of clear standard speech on familiar matters regularly encountered in work, school, leisure, etc - understand the main point of many radio or TV programmes on current affairs or topics of personal or professional interest when the delivery is relatively slow and clear. - understand texts that consist mainly of high frequency everyday or job-related language. - understand the description of events, feelings and wishes in personal letters.
Course contents	- Topics: Family life, contacts, men and women today, work environment, travelling and traffic, nature and environment - Grammar: Subordinate clauses, adjective+article, infinitive construction, Tenses, reflexive pronouns, subjunctive I +II, passive voice
Prerequisites	German A2 level
Assessment Methods	- Tests (mid-term and final test,) performance in class, homework
Recommended Reading and Material	
Attendance	80%
Comments	

Experience Erasmus+: Preparation and Awareness for a Profitable Semester Abroad

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00

Incoming places	Limited
Course description	Do you want to study abroad and do you want to get the most out of your time studying abroad? Then this course is for you! Here, we will be examining cultural differences and how to work with them as well as ways in which universities and systems of education can differ across countries and how to negotiate these differences. This will be a highly interactive course: I will be presenting key aspects of intercultural theory and you will be presenting study experiences in specific countries and working through case studies together. There will also be many opportunities to improve your communication skills in English as a medium of communication (by learning suitable strategies) and also many opportunities to work with and get to know other international students. The course has been running successfully for one semester and I have lots of ideas to make it even more useful and absorbing in the coming semester!
Teaching methods	Theoretical input, group workshops, teamwork, group discussions, independent research, participant preparation of written documents.
Learning outcome	After passing this course successfully students are able to ... - question their cultural stereotypes and prejudices in the context of Erasmus+; - •reflect on different strategies for dealing successfully with likely cultural differences during their semester abroad; - understand the approaches they can use to prepare for the bureaucratic and technical challenges of their semester abroad; - negotiate a variety of typical challenging situations that they will likely face in an international environment.
Course contents	- Tactics, personal behaviours and qualities to be strengthened for achieving success during the semester abroad; - Bettering intercultural awareness and recognition of stereotyping; - Hofstede's cultural dimensions; - Techniques for efficient communication in English as a Lingua Franca; - Practice in overcoming challenges and problems in an intercultural environment (role plays)
Prerequisites	B2 level English
Assessment Methods	- 50% student presentations - 25% completion of participation tasks - 25% final written task

Recommended Reading and Material	- Script
Attendance	75% mandatory
Comments	

BACHELOR DEGREE PROGRAMS

Information and Communication Systems and Services (BIC)

Technical English

Degree programme	BIC
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction

Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Microcontroller Software Design

Degree programme	BIC
Semester	3
Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This class illustrates the use of microcontrollers - in particular, the development of embedded software in order to interface with various peripherals. This involves communication with sensors and control of actuators as well as interfacing with a remote PC for data visualization and remote control.
Teaching methods	Impulse lecture, labs to program a microcontroller by way of a commercial of the shelf evaluation board
Learning outcome	After passing this course successfully students are able to ... - develop bare-metal embedded systems software. - to make efficient use of embedded build systems (cross-development, remote debugging etc.). - explain the functionality of typical peripheral units (interrupt controller, GPIO, Timer, ADC, UART etc.) and be able to configure and program them. - interact with the environment using the microcontroller along with sensors and actuators. - develop embedded software for degree program tailored tasks and projects using a specific commercial of the shelf development

	platform.
Course contents	- CPU Architectures of modern microcontrollers - Cross-Development & Cross-Debugging - Reading and working with Circuit Diagrams, Datasheets, Application Notes and a HAL API Documentation - Interrupts - General Purpose Input/Output (GPIO) - Timer, Real-Time Clock, Watchdog - Analog-to-Digital and Digital-to-Analog Conversion (ADC/DAC) - Universal Asynchronous Receiver/Transmitter (UART) - Serial Peripheral Interface (SPI) - Interchip Communication (I2C) - Implementation of degree program specific tasks and projects
Prerequisites	Programming(solid programming skills using C), Digital Logic & Computer Architectures
Assessment Methods	- Submission of assignments, test, and final project. The final project must be passed to successfully complete the course. Additionally, at least 50% of the total points for this course must be achieved.
Recommended Reading and Material	- H. Bernstein, "Mikrocontroller - Grundlagen der Hard- und Software der Mikrocontroller ATtiny2313, ATtiny26 und ATmega32", Springer Vieweg, 2020, ISBN 978-3-658-30066-1. - M. Fischer, "ARM Cortex M4 Cookbook", Packt Publishing, 2016, ISBN-10: 1782176500. - T. Martin, "The Insider's Guide To The STM32 ARM Based Microcontroller", Hitex Ltd., 2008, ISBN: 095499888. - A. Kurniawan, "STM32 Nucleo-32 Development Workshop", PE Press, 2018. - J. Yiu, "The Definitive Guide to ARM Cortex -M3 and Cortex-M4 Processors", Newnes, 2014, ISBN13: 978-0-12-408082-9.
Attendance	mandatory
Comments	none

Mechanical Engineering (BMB)

Manufacturing Engineering

Degree programme	BMB
Semester	1
Course methods	ILV

Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course students acquire basic knowledge in the fields of production engineering according to DIN 8580.
Teaching methods	Integrated course
Learning outcome	After passing this course successfully students are able to ... - specify essential industrial requirements for manufacturing processes using appropriate technical parameters, - explain selected manufacturing processes from the main groups mentioned in DIN 8580 with regard to basic physical or chemical principles, - describe a manufacturing process using one or more of these methods by means of the underlying process flow logic (material flow).
Course contents	- Requirements for industrial manufacturing processes (incl. measured variables) - Overview of main groups of manufacturing processes (DIN8580)
Prerequisites	Basic knowledge according to admission requirements for the bachelor's program
Assessment Methods	- Participation, homework and Moodle-exams
Recommended Reading and Material	- Förster, R.; Förster, A.: Einführung in die Fertigungstechnik, Springer Vieweg, 2018
Attendance	75%
Comments	The course is held exclusively in English.

Materials Science

Degree programme	BMB
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course you will get an overview of the most important materials of our everyday life - have an insight into atomic levels, learn what these materials are capable of and what we use them for. Learn how to select the right material for a product design and carry out proper material tests in the laboratory course!
Teaching methods	Integrated course
Learning outcome	After passing this course successfully students are able to ... - to explain the basic properties of metallic materials (steel, cast iron, aluminium, copper, titanium, magnesium and their alloys) from a scientific and technical point of view, using practical industrial examples - explain the basics of microscopy and electron microscopy - to be able to make a simple material selection of metals - To be able to name metallic materials. - be able to enumerate metallic materials compared to plastics and ceramics as well as composite materials with advantages and disadvantages - explain the basics of mechanical methods for testing materials as well as selected concrete test methods using appropriate technical terms and quantities (tensile test, hardness test, Charpy, Wöhler)
Course contents	- Terms (e.g. thermal expansion, modulus of elasticity, ...) and material properties - Atomic decomposition & periodic table, chemical bonds - Structure of metals (krz, kfz, hdp) - Iron-carbon diagram - Steel and cast iron - Aluminium materials - Copper Materials - Titanium materials - Magnesium materials - Alloys, phase diagrams - Electrochemistry especially corrosion of metallic materials - Mechanical test methods (tensile test, notched bar impact bending test, hardness test, Wöhler test), PT, MT, VT; UT. - effects of mechanical stress (e.g. deformation, work hardening) - Interaction of material and production technology, example forging - Basic principles of material selection (presentation of software tools) - Differences of the material classes (metals, plastics, ceramics) - Electron microscopic examination of various materials

Prerequisites	Basic knowledge according to admission requirements for the bachelor's programPrior knowledge of manufacturing technology from the cource "Manufacturing Engineering"
Assessment Methods	- Participation and presentation, Moodle tests and final examination
Recommended Reading and Material	- - Ashby, M.F.; Jones, D.R.H.: Engineering Materials 1: An Introduction to Properties, Applications and Design, Elsevier, 2011
Attendance	75%
Comments	More detailed information can be found in the Moodle course.

Technical English

Degree programme	BMB
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication

	- Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Applied Computer Science

Degree programme	BMB
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	Software has become part of all areas of industrial engineering. Therefore, a basic education in applied computer science and the development of software are standard components of the graduates' toolbox. During the teaching, special emphasis is given to the abstraction of requirements and, subsequently, the realisation of corresponding software systems. In the first part of the course you will learn about the fundamentals of computer architecture, operating systems and virtualizations and you will work hands-on with file systems and bootable USB-Drives. In further classes and self-studies you will get insights into programming with python and the creation of algorithms using flowcharts in the first place and subsequently by using Python as a programming language. Python is a high-level programming language with use-cases in mechanic engineering, data aggregation, data analysis and many more.

	Working hands-on with datatypes and control structures will provide you the basic skills to create programs. Practical weekly moodle tests will keep you on track and will consequently challenge you to gain implementation expertise. Hands-on working with collections and files will expand your options in how to solve problems using your programming skills. In later classes you will expand your skills even further by working with an online simulation of a Raspberry Pi and by processing Open Data using APIs.
Teaching methods	Combination of classes and self-study phases
Learning outcome	After passing this course successfully students are able to ... - understand and explain architectures, operating systems and peripherals of computers - analyze and explain problems/tasks, create algorithmic solutions (using flow charts) and implement them using structured programming techniques - understand and apply fundamental tasks of programming languages: reading, processing and output of structured data, basic operations in data structures, regular expressions, control structures (conditional queries, loops, functions). - execute software tests - develop practical applications on a Raspberry Pi simulation - develop practical applications based on open data
Course contents	- Introduction Computer Science: Computer architecture, hardware, operating systems - Software and its characteristics - Programing paradigms, programing languages and their fields of application - Software development, development processes - Microcontroller vs. Microprocessor - Introduction to programming with python - Data processing: reading, processing, output of data - Contrul structures and loops - Dictionaries - Functions
Prerequisites	none
Assessment Methods	- Weekly moodle tests - Practical exercises - Moodle exam at the end of the course
Recommended Reading and Material	- Christian Baun, Operating Systems / Betriebssysteme, DOI: 10.1007/978-3-658-29785-5

	- Connor P. Milliken, Python Projects for Beginners – A Ten-Week Bootcamp Approach to Python Programming, DOI: 10.1007/978-1-4842-5355-7 - Sunil Kapil, Clean Python – Elegant Coding in Python, DOI: 10.1007/978-1-4842-4878-2 - Python® Notes for Professionals, https://books.goalkicker.com/PythonBook/ (free)
Attendance	75%
Comments	

Renewable Energies (BEE)

Technical English

Degree programme	BEE
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)

Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Biomass Combined Heat and Power Systems

Degree programme	BEE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	Bioenergy supply with focus on combined heat and power technologies
Teaching methods	Integrated course with presentations and project work
Learning outcome	After passing this course successfully students are able to ... - to design the processes and main components of biomasse CHP plants - assess and evaluate biomass CHP conversion technologies and their main usage: steam processes, organic rancine cycle processes (ORC), gas engines - assess and evaluate the operation procedure of heat and/or power driven biomass CHP plants

	- describe the energetic utilization possibilities of biomass through different conversion routes
Course contents	- Engineering of components and thermal process design of biomass CHP plants - Biomass steam turbine plants - Biomass ORC plants - Biomass gas engines - Production of biogenic fuels for the respective biomass technologies
Prerequisites	Basics in Physics, Thermodynamics and Thermal Biomass utilisation
Assessment Methods	- Presentations, test, and project work
Recommended Reading and Material	- Kaltschmitt, Hartmann, Hofbauer (2016): Energie aus Biomasse, Springer VDI Verlag - Schmitz, Schaumann (2010), Kraft-Wärme-Kopplung, Springer VDI Verlag - Obernberger et al. (1999): Dezentrale Biomasse Kraft Wärme Kopplungstechnologie, Bios Verlag
Attendance	75 %
Comments	

Conventional Power Plant Technology

Degree programme	BEE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Basics of gas combined cycle gas turbines
Teaching methods	Flipped Classroom: theory tests and final exam
Learning outcome	After passing this course successfully students are able to ... - to analyze gas combined cycle gas turbines processes - analyse measures for the most efficient use of energy - analyse thermodynamic processes - propose best operation mode, heat or electricity related, for most efficient use

	- evaluate and critically scrutinize CO2 capture measures - propose measures for combined operation with renewable energy sources and with sustainable fuels
Course contents	- Thermodynamic fundamentals of the Joule/Brayton cycle and the Clausius Rankine cycle - Basics and in-depth analysis of combined cycle gas turbines - Realistic design of combined cycle gas turbine´s components and integration into energy systems - Carbon capture and storage technologies for CO2 separation - Future directions of combined cycle power plants and the role of hydrogen and synthetic fuels
Prerequisites	Basics in Physics and Thermodynamics
Assessment Methods	- Theory tests and final exam
Recommended Reading and Material	- Zahoransky (2015): Energietechnik, Springer Vieweg Verlag; - Strauß (2016): Kraftwerkstechnik, Springer Verlag;
Attendance	75 %
Comments	

Heat Grids Laboratory

Degree programme	BEE
Semester	5
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Measurement exercises concerning simulation, load behaviour and systemic integration of plants for urban heating and cooling supply
Teaching methods	•Preparation for exercise through self-study (Moodle-Test)•Presentation of the laboratory exercise and exercise in groups•Recording of measured values•Writing of a laboratory report
Learning outcome	After passing this course successfully students are able to ... - measure and analyse the main characteristics of transfer stations for heating and cooling supply under laboratory test conditions - configure and simulate thermal networks - optimise thermal networks in laboratory tests with regard to load

	behaviour and to subject them to an economic analysis - analyse the tasks of the load distributor of an urban heating and cooling supplier
Course contents	- Safety instructions, laboratory regulations, protocol guidelines - Transfer stations for heating and cooling supply, - Simulation of thermal networks, - Load behaviour of thermal networks and evaluation with regard to technical-economic-ecological assessment - Laboratory excursion: load distributor, heating and cooling supply
Prerequisites	Basics in mechanical engineering, M2.3 Electrical engineering 2, M2.1 Thermodynamics
Assessment Methods	- Laboratory report and active participation
Recommended Reading and Material	- Schäfer (2013): Fernwärmeversorgung, Springer - Cube, Steimle, Lotz (1997): Lehrbuch der Kältetechnik Band 1 und 2, Verlag: Hüthig Jehle Rehm; Auflage: 4. Aufl.
Attendance	100 %
Comments	

Heat Grids

Degree programme	BEE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Basics in thermal grids with focus on district heating and cooling
Teaching methods	Integrated lecture and exercise project
Learning outcome	After passing this course successfully students are able to ... - describe the main components of energy grids for district heating and cooling - describe the function and the operation of thermal energy grids - calculate the main parameters of thermal energy grids - describe the systems effects between producer and supplier on the operation of energy grids for district heating and cooling - describe the function and the operation of energy grids under

	consideration of renewable energy integration - calculate and simulate in an easy way the operation of thermal energy grids
Course contents	- Structure of district and cooling networks - design parameters of thermal grids - techn.-econ.-ecol. efficiency parameters of thermal grids - heating/cooling transfer station - economic parameters - Consumer analysis and decentralised thermal grid design - Thermal grids under EU/A conditions, responsability of grid operators, Effect of decentralised energy on grid quality, new solutions for the operation of distribution networks - Potentials of district cooling in EU/A, integration of district cooling in large heating networks, ecological effects of district cooling, technical aspects of district cooling, market and costs;
Prerequisites	Basics in Physics and Thermodynamics
Assessment Methods	- exercise project of a grid simulation and final examination
Recommended Reading and Material	- Schäfer (2013): Fernwärmeversorgung, Springer - Cube, Steimle, Lotz (1997): Lehrbuch der Kältetechnik Band 1 und 2, Verlag: Hüthig Jehle Rehm; Auflage: 4. Aufl.
Attendance	75 %
Comments	

Electricity Grids

Degree programme	BEE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The electrical networks module gives a practical overview of the design and operation of electrical networks (in urban areas) from a systemic point of view.
Teaching methods	Integrated lecture
Learning outcome	After passing this course successfully students are able to ...

	- describe the main components of energy grids for electricity, - describe the function and the operation of the electricity grid, - calculate the main parameters of electricity grids - describe the systems effects between producer, supplier and storages on the operation of electricity grids - describe the function and the operation of electricity grids under consideration of renewable energy integration - calculate and simulate in an easy way the main parameters (current, voltage, power) of electric energy grids
Course contents	- Structure of el. grids, main parameters, switch gears, measuring transformers, transformer and controller, power lines, safety components; - Integration of renewables in electicity grids - El. grids under EU/A conditions, responsability of grid operators, Power Quality, Effect of decentralised energy on power quality, new solutions for the operation of distribution networks; - Simulation of distributed networks
Prerequisites	• Electrical engineering 1 and 2• Electrical Power Engineering• Thermodynamics
Assessment Methods	
Recommended Reading and Material	- Hosemann (2000): Elektrische Energietechnik, Bd3 Netze, Springer - Schwab (2011): Elektroenergiesysteme, Erzeugung, Transport, Übertragung und Verteilung elektrischer Energie, Springer Verlag
Attendance	75 %
Comments	

Electricity Grids Laboratory

Degree programme	BEE
Semester	5
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In the Electrical Networks Laboratory module, the contents imparted in the "Electrical Networks" and "Energy Generation Systems" modules are applied with practical exercises in the laboratory.

Teaching methods	· Preparation for exercise through self-study (Moodle-Test)· Presentation of the laboratory exercise and exercise in groups· Recording of measured values· Writing of a laboratory report
Learning outcome	After passing this course successfully students are able to ... - • to measure and interpret the energetic performance of components of energy generation, storage, consumption and conversion
Course contents	- Experimental setup of the most important metrological procedures for assessing the quality of machines and systems for energy conversion - Knowledge of solving measurement tasks - Metrological analysis and evaluation of the energetic performance of energy conversion components - Metrological analysis and evaluation of the energetic performance of heat pump systems, photovoltaic systems
Prerequisites	• Electrical networks• Automation 1• Power generation plants
Assessment Methods	
Recommended Reading and Material	- Hosemann (2000): Elektrische Energietechnik, Bd3 Netze, Springer - Schwab (2011): Elektroenergiesysteme, Erzeugung, Transport, Übertragung und Verteilung elektrischer Energie, Springer Verlag
Attendance	100 %
Comments	

Strategies for Urban Energy Supply

Degree programme	BEE
Semester	5
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Concepts of the current energy supply in cities and strategies for the future.
Teaching methods	project work
Learning outcome	After passing this course successfully students are able to ... - comment the background of urban energy strategies

	- give examples for environmentally friendly urban energy strategies - give best practise solutions for urban energy strategies
Course contents	- Basics in urban energy strategies; - best practises of urban energy supply, - potentials of renewable energies in urban areas, - legislation concerning urban energy strategies, - presentations of selected guest lecturers
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	75 %
Comments	

Biomedical Engineering (BBE)

Basics of Assistive Technologies

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Practice-oriented treatise on the subject of Active Assistive Technologies
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to understand the functions of the human sensory organs and also frequently occurring damage in order to develop suitable technical measures to compensate for failures. - to know the physiological changes typically associated with the ageing process in order to design suitable technical measures to compensate for such failures. - to transfer the basic principles of multimodal human-machine interfaces to augmentative and alternative applications for disabled

	and elderly people. - to practically apply the most important rules of accessible design and universal design
Course contents	- Definitions and objectives of rehabilitation technology - What is disability? (based on the WHO definitions, ICIDH and ICF) - Medical basics (anatomy and physiology with reference to disabilities) - Augmentative and alternative man-machine Interfaces - Communication technology for people with disabilities and elderly people - Tools for orientation and navigation - Aids for everyday life and work - Smart Homes, environmental controls and service Robots - Barrier-free environmental design and universal design
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Applications of AAT

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

UX aspects of AAT

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English

ECTS Credits	2.00
Incoming places	Limited

Accessible Webtechnology

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Assistive Technologies Plattformen

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Technical English

Degree programme	BBE
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written

	skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Bioinformatics

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00

Incoming places	Limited

Medical Imaging and Analysis

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	Medical imaging is crucial to the diagnosis, therapy planning and therapy monitoring of various pathologies. Essentially, a distinction can be made between anatomical (X-ray, CT, MRI, ultrasound) and functional (PET, SPECT, etc.) imaging modalities. While anatomical imaging modalities, as the name suggests, provide information about the anatomical features, functional imaging modalities provide information about the metabolic function of certain organ systems or tumors. Depending on the diagnostic question and indication of the imaging, different processing and analysis methods have to be applied in order to obtain a data set from the image that can be evaluated by medical personnel. This process is the subject of the course Medical Imaging & Analysis.
Teaching methods	The teaching and learning materials provided include video recordings of lectures on individual topics, as well as publications from research institutions or other subject-related international organizations. For the exercises and assignments, students will need MATLAB and other freely available software tools.
Learning outcome	After passing this course successfully students are able to ... - Develop simple prototypes for basal image processing in concrete medical problems in MATLAB. - Understand the functionality of simple image processing operations in commercial software and apply them appropriately to the situation. - transfer medical image data to other systems for further use in medical technology issues.
Course contents	- Basics of Medical Imaging Physics & Imaging Modalities - Image Representation, File Formats and Simple Operations - Operations in Intensity Space - Filtering & Image Transformations

	- Spatial Transformations & Rendering
Prerequisites	Mathematik für Engineering Science 1 Mathematik für Engineering Science 2 Grundlagen der Programmierung Anwendungen der Programmierung in Life Science Engineering Grundlagen der Physik für Ingenieurswissenschaften
Assessment Methods	- Performance assessment will be based on programming assignments (50%) and a final exam (50%).
Recommended Reading and Material	- W. Birkfellner, with contributions by M. Figl, J. Hummel, Z. Yaniv and Ö. Güler: Applied Medical Image Processing – A Basic Course, 2nd Edition, CRC Press, ISBN: 978-1-4665-5557-0
Attendance	Attendance of minimum 75% is mandatory. If attendance is less than 75% the first exam attempt is considered negative.
Comments	

Medical Data Engineering 2

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Continuation of the course "Medical Data Engineering 2
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to independently develop software for the health care system using the services of the Health Information Network (GIN, Austrian eCard System, electronic insurance card). - to develop database applications for the health care system. - to document the work in projects. - in writing and analysing texts the - to apply basic rules of scientific work, distinguishing a scientific approach from a non-scientific (everyday) one
Course contents	- Software development in health care projects - IHE and basic standards - C# Programming

	- Austrian eCard infrastructure, - Health Information Network GIN, Applications
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Biomedical Ex Vivo Models

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course, students learn selected ex vivo models, which are important tools for biomedical research. There is a growing need for ex vivo systems, lab-on-a-chip technologies, and disease models for biomedical problems to overcome the shortcomings and drawbacks of traditional in vitro systems and animal models. A key advantage is the ability to perform tests or measurements that would not be possible or ethical in living subjects. This includes, for example, the study of the brain, spinal cord and peripheral nerve tissue regeneration or the measurement of physical, thermal, electrical, mechanical, optical and other tissue properties.
Teaching methods	Self-study preparation, in class lectures, Moodle quizzes
Learning outcome	After passing this course successfully students are able to ... - Name common ex vivo organ models and explain their scope of application. - Explain selected respiratory and optical models. - Describe methods for creating cell-based systems and organoids. - Explain applications of cell-based systems and organoids in disease models and testing of chemicals and discuss them using specific examples.

Course contents	- Definitions - in vitro, in vivo, ex vivo, and in silico - 3D-Organoids - Modelling of different organs based on microfluidic technologies - Modelling of the lung as a whole organ - Modelling of the eye
Prerequisites	ILV Biochemistry and Molecular Biology
Assessment Methods	- Moodle exams during the classes (30%) - Moodle exam (final exam) during the last class (70%)
Recommended Reading and Material	
Attendance	Attendance is compulsory
Comments	

Biomedical Engineering Projects

Degree programme	BBE
Semester	5
Course methods	PRJ
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Students develop advanced specialized knowledge by working on interdisciplinary problems (PBL cases) on biomedical engineering topics.
Teaching methods	student-centered, problem-based learning
Learning outcome	After passing this course successfully students are able to ... - Analyze and discuss complex interdisciplinary problems in biomedical engineering in a broader context in a structured manner as part of a team. - identify knowledge gaps and to conduct targeted research based on this - to select, prepare and present own proposals for solutions and to defend them with scientific argumentation - Explain and present the content and results of one's own or another's scientific publication in a comprehensible manner - Apply the basic rules of scientific work when writing and analyzing

	texts - research selected scientific sources and cite them correctly in own texts - Prepare and present an academic poster
Course contents	- Scientific Writing - Literature Research - Academic Poster - Presentation - Academic Discussions
Prerequisites	Basic knowledge and special knowledge from the semesters 1-4.
Assessment Methods	- immanent assessment method
Recommended Reading and Material	
Attendance	
Comments	

Current Topics in Life Science Engineering

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course, students will attend a series of expert lectures from the entire field of Life Science Engineering. Life Science Engineering.
Teaching methods	Expert lectures, self-study with current articles and videos, feedback from lecturers, peer-review.
Learning outcome	After passing this course successfully students are able to ... - ...name different research topics in the field of Life Science Engineering. - ...conduct research on selected research topics in the field of Life Science Engineering. - ...explain the results of research in the form of a short video.
Course contents	- Overview of tasks and activities in the subject areas of the study programme and beyond

Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Photonics in Biomedical Engineering

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Nuclear Medicine and Radiation Protection

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Basics of nuclear medicine and radiation protection
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to describe examples from atomic, nuclear and radiation physics for medical technology - to explain the fundamental interactions between ionising radiation and electron sheath. - to reproduce the fundamental models of nuclear physics and radioactivity. - to reproduce the principles of signal processing in nuclear medical technology.

- to apply basic knowledge of radiopharmaceuticals in practice.
- to participate in projects concerning nuclear medical technology.
- be able to explain the physical principles of radiation physics in medicine.
- to explain which dose terms are relevant in radiation protection.
- explain the basic principle in radiation protection (ALARA principle) and its practical implementation.
- to categorise radiation damage and to describe the corresponding radiobiological processes.
- to operate a radiation protection measuring instrument and to be able to explain the operating modes.
- designate the tasks and duties of a radiation protection officer.
- to explain the legal procedures in licensing procedures.
- to act as radiation protection commissioner in medicine in accordance with AllgStrSchV § 41, whereby a corresponding special training must be completed.

Course contents

- Historical overview of nuclear physics
- Elementary charge, Bohr model
- X-rays, Auger effect
- wave-particle dualism
- Photoelectric effect, Compton scattering, pair formation
- Quantum numbers
- Periodic Table
- Heisenberg uncertainty relation, Schrödinger equation
- Historical overview of nuclear physics
- Nuclear models
- Radioactivity and nuclear reactions
- Research and applications in nuclear physics
- Basics of nuclear medicine
- radiation detectors, gamma camera
- Scintigraphy, PET, SPECT, multi-modal imaging
- Fundamentals of nuclear physics including the physics of ionising radiation
- Radiation sources
- Fundamentals of radiation biology
- Radiation damage, prevention and detection
- Dosimetry
- Fundamentals of radiation protection
- Legislation in the field of radiation protection
- Measuring instruments
- Medical and physical control

	- Radiation accidents, first aid - exercises: Handling of equipment for personal and Local dose determination including the use of Test lamps - Radiopharmaceuticals and their production - Dosimetry in nuclear medicine
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Web Based Medical Applications

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Main features, practical examples and state-of-the-art in the field of "Web-Based-Medical-Applications
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - List common web-based medical applications and discuss their characteristics - explain essential requirements for web-based medical applications - Implement simple platform diagnostic solutions
Course contents	- Basics of web development - Basics of frontend and backend aspects of medical Systems - Basic development opportunities of web-based solutions
Prerequisites	
Assessment Methods	
Recommended Reading and Material	

Attendance

Comments

Mobile Computing in Medical Applications

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Methods in Cell & Tissue Engineering

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The course provides an overview of current methods in Cell&Tissue Engineering
Teaching methods	Self-study and presence phases alternate. In self-study, basic content is developed on the basis of the documents provided by the lecturers, in the presence phase these are discussed and deepened together.
Learning outcome	After passing this course successfully students are able to ... - explain the basic principles of microscopy and the commonly used light (visible light and fluorescent light) and electron microscopy techniques with their respective advantages and disadvantages - give an overview of preclinical analysis methods and to compare and classify them for the field of tissue regeneration - explain the basic steps involved in the preparation and characterization of tissue samples (e.g.: routine staining, immunohistochemistry, histomorphometry) and possible applications - depict bioreactors schematically and explain the processes in these

	reactors - describe the function, effect on cells, and advantages and disadvantages of biomaterials - outline methods by which the genome of the cell can be modified and cell signaling pathways can be influenced
Course contents	- Basics of microscopy - Electron microscopy - Tissue FAXs and preclinical imaging - Immunohistochemistry - Molecular cloning - Biomaterials, mechanical sensing and bioreactors
Prerequisites	Cell Culture TechniquesCel culture LabMolecular Genetics
Assessment Methods	- Entrance tests, group works and homeworks, final exam
Recommended Reading and Material	- Current documents are provided by the lecturers.
Attendance	There is a general requirement of 75% attendance. No reasons need to be proven or made credible for absenteeism within the remaining 25% (tolerance limit).
Comments	

Project in Developmental Biology

Degree programme	BBE
Semester	5
Course methods	PRJ
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The project provides insight into developmental biology. Central points include early development in mice, humans and zebrafish as well as the role of stem cells in development. In the practical part at the end of the project, experiments on zebrafish embryos and larvae are performed and documented.
Teaching methods	Self-study and presence phases alternate; basics are worked out in the self-study phase, which are then discussed and deepened in the presence phase. At the end of the course, a staining of the blood

	vessel system of zebrafish in different stages will be performed in the laboratory.
Learning outcome	After passing this course successfully students are able to ... - Describe the processes of embryonic development, from fertilization to germ layer specification - Compare early embryonic development stages of humans and mice - Explain the basics of how the cells of our tissues and organs come to be specified and placed in their correct positions - Understand the origin of the germ layers, the tissues that arise from them and thereby, the embryonic origin of different cell types - Identify the master switches and stem cells that drive embryonic organ formation - Understand how the knowledge of embryonic development can aid in in vitro cell differentiation - Describe how stem cells contribute with which potential to the development and assess how to test for the distinct stem cell status - Understand how these properties of stem cells can be used in research and in the development of the therapies - Understand the principles of developmental biology, the development of zebrafish and of its blood vessels - Generate templates for standard operating procedures from publications - Conduct experiments on an important model system in developmental biology, the zebrafish
Course contents	- Early development of mouse and human - Stem cells in development - Zebrafish as a model system - Classical Developmental Biology
Prerequisites	Course "Allgemeine Chemie" in the 1st semester
Assessment Methods	- entrance tests - Moodle final exam - report about laboratory project - group assignments
Recommended Reading and Material	- Current publications, slide sets, audio files are provided.
Attendance	In principle, attendance is compulsory to the extent of 75%. For absences within the remaining 25% (tolerance limit), no reasons need to be given.
Comments	

Current Cell Technology Approaches

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The course provides an insight into current approaches in cell technology such as protein- and RNA detection methods and tools for genome engineering and molecular forensics.
Teaching methods	Self-study phases and presence phases alternate. In self-study, the basics are developed with videos, documents etc. provided by the lecturers. This knowledge is discussed, tested, deepened and applied in group works in the presence phase.
Learning outcome	After passing this course successfully students are able to ... - name antibody-based analytical methods and explain their principles - explain the process of reverse transcription and quantitative PCR and the detection principle of a qPCR - design primers for qPCR applications and be able to evaluate RT-qPCR results - outline approaches to introduce mutations into the genome of cells, explain components and mechanisms of the CRISPR/Cas9 tool, and give examples of current applications of genome engineering - explain the main procedures and theoretical background of forensic DNA analysis and profiling - list advantages and disadvantages of analytical approaches in forensics, and give an overview on common complications and appropriate troubleshooting strategies - name procedures, applications and theoretical backgrounds for the use of specific genetic markers in criminal prosecution and to select suitable markers depending on the task at hand
Course contents	- Western blot and ELISA - RTqPCR - Gene editing tools - Molecular Forensics
Prerequisites	Instrumentelle Analytik in der LabormedizinBiochemie und

	MolekularbiologieBiochemie LaborCell Culture Techniques
Assessment Methods	- Entrance tests, Group work, Moodle Final Exam
Recommended Reading and Material	- Current publications and documents will be provided by the lecturers; “Freshney's Culture of Animal Cells" (Edition 2021)
Attendance	There is a general requirement of 75% attendance. No reasons need to be proven or made credible for absenteeism within the remaining 25% (tolerance limit).
Comments	

Biomedical in Silico Modeling and Simulation

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Modelling and simulation is an emerging and growing field in the industry and in biomedical engineering in particular. With modelling and simulation techniques, it is possible to conduct research in areas that would not be possible in the traditional way. This can be for ethical, technical or even financial reasons. Examples of developments that are now often supported by modelling and simulation include pacemakers (for ethical and financial reasons), hip implants (for technical and ethical reasons), the development of new drugs and many more.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - Model, simulate, and explain simple natural processes in biomedical engineering using ordinary differential equations. - To explain the principle of the "read-across procedure". - Grundlegende cardiovasculäre und respiratorische Modelle zu entwerfen und zur Nutzung einfacher Simulationen anzuwenden
Course contents	- Knowledge and skills to represent natural processes using modeling and simulation (e.g. cell growth, movements, muscle fibers,...).

	- Skills in the use of numerical mathematics and the estimation of available results. - Presentation and analysis of the results - Read-Across procedure - Conversion of biological processes into simplified mathematical models
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Neurorehabilitation

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Practical applications of neurorehabilitation
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to be able to reproduce the not only technical equipment of a neurological rehabilitation centre, to explain the most frequent deficits and needs of the patients on site, and to reproduce the possibilities of a connection to their own professional orientation. - to describe the functions of the human sensory organs and also frequently occurring damage, in order to develop suitable technical measures to compensate for failures. - to be able to reproduce the physiological changes typically associated with the ageing process in order to design suitable technical measures to compensate for such failures. - to transfer the basic principles of multimodal man-machine interfaces to augmentative and alternative applications for disabled

	and elderly people.
Course contents	- Visual perception - Auditory perception - Tactile perception - Aging - Human-Computer Interface
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Neural Engineering

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Biomechanics

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	The course´s first block Biomechanics of Human Tissue focuses on the understanding of physiological and biomechanical principles underlying skeletal muscle force production. Furthermore, students learn to differentiate between human tissue such as bone, cartilage, muscle, tendons and ligaments, based on their mechanical

	properties. In Applied Biomechanics, the second block, students learn to mathematically solve biomechanical problems of both statics and dynamics such as calculating the joint forces during a lifting task.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - To describe the physiological and biomechanical principles underlying skeletal muscle force production - To interpret and compare stress-strain diagrams of various materials - To describe the mechanical properties of human tissue such as bone, cartilage, muscle, tendons and ligaments - To mathematically solve biomechanical problems of statics and dynamics (e.g. calculation of force-distribution during lifting)
Course contents	- Rate coding and population coding in skeletal muscle - Muscle fiber composition - Force-length and force-velocity relationship - Muscle architecture and moment arm - Fundamental principles of stress, strain, elasticity and plasticity - Mechanical properties of bone, cartilage, muscle, tendons and ligaments - Fundamental principles of statics and dynamics - Mathematical problems of statics and dynamics
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Medical Hospital Equipment

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	Introduction in the field of "Medical Hospital Equipment"
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to present the most important aspects of blood compatibility and to identify critical points in the design of blood contacting components. - describe the procedures of dialysis, haemofiltration, peritoneal dialysis and apheresis and compare them in their fields of application - To describe the mode of operation of oxygenators and heart-lung machines and to justify the necessary alarm functions and possible side effects. - to describe modern multifunctional pacemakers and to select them for different applications. - To describe the design of respirators and discuss the function and possible malfunctions of the individual components. - explain the functioning of external defibrillators and identify the potential hazards they pose and the influence they have on other medical devices. - to apply procedures to optimise operating safety in concrete examples.
Course contents	- Aspects of blood compatibility of medical devices - Technologies and equipment for blood purification and apheresis - heart-lung machine and extracorporeal Membrane oxygenation - Lung mechanics, ventilators and lung Support - Complex pacemakers (Defi pacemakers, Multi-chamber systems, resynchronisation and de- remodelling method) - Defibrillators - Usability optimisation in medical devices (exercise)
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Electronic Engineering (BEL)

Microcontroller Software Design

Degree programme	BEL

Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course covers microcontrollers, in particular to program software in order to interface with various peripherals.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - design and analyze bare-metal software for microcontroller systems, - use build systems for microcontrollers (cross-development, remote debugging ...) efficiently, - configure and program typical peripheral units of microcontrollers (e.g. GPIO, Timer, Interrupt Controller, ADC/DAC, UART, SPI, I2C etc.), - control sensors and/or actuators with the help of microcontroller's peripheral units - as well as to develop applications, as they occur in typical electronic systems, in the context of hands-on projects.
Course contents	- Architecture of modern microcontrollers - Cross-Development & Debugging - Interrupts - General Purpose Input/Output (GPIO) - Timer, Real-Time Clock, Watchdog - Analog-to-Digital and Digital-to-Analog Conversion (ADC/DAC) - Serial interfaces like UART, SPI or I2C - Implementation of tasks and projects as they occur in typical electronic systems
Prerequisites	Courses "Hardware-related Software Development" and "Fundamentals of Digital Systems"
Assessment Methods	- Exam, assessment of individual tasks and projects
Recommended Reading and Material	- M. Barr, Programming Embedded Systems in C and C++, 1999, O'Reilly Media, Inc. - W.A. Smith, C Programming for Embedded Microcontrollers, 2008, Elektor International Media BV - J. Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4

	Processors, 2014, Newnes, ISBN 978-0-12-408082-9 - M. Fischer, ARM Cortex M4 Cookbook, 2016, Packt Publishing, ISBN 1782176500
Attendance	mandatory
Comments	

Technical English

Degree programme	BEL
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering topics. Moreover, students will advance their technical verbal and written skills by creating technical object and technical process descriptions specifically for technical professional audiences and engineering purposes.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary in English, - create and understand technical process instructions in English, - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description).
Course contents	- Visualizing technical descriptions in English - Describing technical visualizations in English - Technical object descriptions in English - Technical process descriptions in English - Technical English talk - Excercises on selected technical topics
Prerequisites	B2 level English
Assessment Methods	- group tasks, language tasks, in-class writing

Recommended Reading and Material	- R. Murphy, English Grammar in Use, 5th Edition, 2019, Klett Verlag - A. Oshima, A. Hogue, Writing Academic English, 4th Edition, 2006 Pearson Longman
Attendance	obligatory
Comments	The course takes place during the day (morning or early afternoon)

Microcontroller Software Design

Degree programme	BEL
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course covers microcontrollers, in particular to program software in order to interface with various peripherals.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - design and analyze bare-metal software for microcontroller systems, - use build systems for microcontrollers (cross-development, remote debugging ...) efficiently, - configure and program typical peripheral units of microcontrollers (e.g. GPIO, Timer, Interrupt Controller, ADC/DAC, UART, SPI, I2C etc.), - control sensors and/or actuators with the help of microcontroller's peripheral units - as well as to develop applications, as they occur in typical electronic systems, in the context of hands-on projects.
Course contents	- Architecture of modern microcontrollers - Cross-Development & Debugging - Interrupts - General Purpose Input/Output (GPIO) - Timer, Real-Time Clock, Watchdog - Analog-to-Digital and Digital-to-Analog Conversion (ADC/DAC) - Serial interfaces like UART, SPI or I2C - Implementation of tasks and projects as they occur in typical

	electronic systems
Prerequisites	Courses "Hardware-related Software Development" and "Fundamentals of Digital Systems"
Assessment Methods	- Exam, assessment of individual tasks and projects
Recommended Reading and Material	- M. Barr, Programming Embedded Systems in C and C++, 1999, O'Reilly Media, Inc. - W.A. Smith, C Programming for Embedded Microcontrollers, 2008, Elektor International Media BV - J. Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, 2014, Newnes, ISBN 978-0-12-408082-9 - M. Fischer, ARM Cortex M4 Cookbook, 2016, Packt Publishing, ISBN 1782176500
Attendance	mandatory
Comments	

Technical English

Degree programme	BEL
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering topics. Moreover, students will advance their technical verbal and written skills by creating technical object and technical process descriptions specifically for technical professional audiences and engineering purposes.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary in English, - create and understand technical process instructions in English, - identify and produce technical text types according to their intended audience and communication purpose (for example a technical

	article and a process description).
Course contents	- Visualizing technical descriptions in English - Describing technical visualizations in English - Technical object descriptions in English - Technical process descriptions in English - Technical English talk - Excercises on selected technical topics
Prerequisites	B2 level English
Assessment Methods	- group tasks, language tasks, in-class writing
Recommended Reading and Material	- R. Murphy, English Grammar in Use, 5th Edition, 2019, Klett Verlag - A. Oshima, A. Hogue, Writing Academic English, 4th Edition, 2006 Pearson Longman
Attendance	obligatory
Comments	The course takes place in the evening

Computer Science (BIF)

Technical English

Degree programme	BIF
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion

Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Sports Engineering and Ergonomics (BHF)

Biomechanics and Ergonomics Laboratory

Degree programme	BHF
Semester	3
Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Introduction to the practical implementation of biomechanical measuring methods and data evaluation of the parameters obtained
Teaching methods	

Learning outcome	After passing this course successfully students are able to ... - Use different methods to assess human motion (force plate, plantar pressure measurement, 2D video analysis) - Explain changes in ground reaction forces due to different walking speeds - Calculate plantar pressure distribution in walking and running - Calculate joint angles and velocities based on 2D motion analysis data - Use numerical computing software for basic data analysis - Analyse and display measurement data from different biomechanical measurements - To explain the origin of myoelectric signals, conduct an electromyography on a human subject - to present the mean time and amplitude normalized muscle activity of a cyclic movement.
Course contents	- Force plates (technical background, application, conclusion) - Pressure insoles (technical background, application, conclusion) - 2D motion analysis (setup, calibration, marker tracking) - Data analysis and parameter extraction using MATLAB - Data presentation (diagrams, boxplots, tables) using MATLAB - Surface electromygraphy
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Technical English

Degree programme	BHF
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language

	toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Mechatronics/Robotics (BMR)

Technical English

Degree programme	BMR
Semester	1

Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Mobile and service robotics

Degree programme	BMR
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course discusses the foundations of mobile and service robots. The main content of this course is classic mobile robot localization, path planning and path control. The participants learn the main concepts to control a mobile robot relying on traditional methods. During this course several exercises will be implemented by each participant relying on the robot operating system (ROS). Furthermore, they are going to implement and solve a mobile robot problem.
Teaching methods	Integrative lecture, exercises
Learning outcome	After passing this course successfully students are able to ... - Understand the mechatronic modules of a module robot - Calculate and implement the kinematic model of mobile robots - Understand problems and solution of a mobile robot - Implement intelligent modules for mobile robot navigation
Course contents	- Modules of a mobile robot - Kinematics of mobile robots - Path planning with and without maps - Foundations of probabilistic robotics - ROS
Prerequisites	Math, industrial robots, C++
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Siegwart, R. und Nourbakhsh, I.R.; (2004) Introduction to Autonomous Mobile Robots (Intelligent Robots and Autonomous Agents), MIT Press - Russell, S., Norvig, P.; (2012) Artificial Intelligence: A modern approach, Pearson
Attendance	75%

Comments

Business Informatics (BWI)

Tool-Based Data Ops

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The fourth part of the specialization "Business Applications" tackles the tool-based development of data base-intensive applications.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - assess the advantage of No-Code/Low-Code applications vs. classic software development - identify use cases for No-Code/Low-Code - Choose a suitable NCLC development platform - Using some platform (e.g., MS Power Apps), create simple business applications - Apply security mechanisms - Integrate the application with existing systems using interfaces
Course contents	- No-Code and Low-Code development platforms - Functions of Appluication Builder - Integration of DB applications into existing infrastructure - security aspects
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Business Simulation Game

Degree programme	BWI
Semester	5
Course methods	UE
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this sub-module, students deepen, expand and cross-link the business management skills taught in previous semesters within the course of a business game.
Teaching methods	Flipped Classroom
Learning outcome	After passing this course successfully students are able to ... - formulate value-oriented corporate goals - differentiate between strategic and operative business decisions - optimally coordinate the various marketing policy instruments - evaluate the advantages of investments using suitable calculation methods - develop an optimal production and sales program - weigh up between in-house production and external procurement - conduct a break-even analysis - calculate balance sheet ratios for the interpretation of financial statements - identify rationalization potentials and take appropriate measures to realize them - deal with large amounts of information in a structured way
Course contents	- Strategic Management - Accounting - Balance Sheet Analysis - Procurement Management - Production Management - Marketing - Investment Planning - Cost Accounting
Prerequisites	Fundamentals of Business Administration
Assessment Methods	- Immanent performances (100%)
Recommended Reading and Material	- Wala, Grobelschegg: Kernelemente der Unternehmensführung, Linde-Verlag

Attendance	Mandatory
Comments	Details see Moodle course

Digital Innovation

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Digital Business Planning

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Business Process Engineering

Degree programme	BWI
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Students learn about the definition of business processes and the use of business processes in an organization. Based on different aspects, students also learn to assess, model, improve and document business processes.

Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - discuss relevant aspects of organization-wide business process management , - assess and describe business processes, - model business processes (e.g. with BPMN), - develop a business process handbook, - apply techniques and methods of process improvement, - apply methods of business process assessment and BPM maturity models.
Course contents	- Introduction to Business Process Management & Strategic Business Process Management - Process identification - Process discovery - Qualitative process analysis and costs - Quantitative process analysis and simulation - Process redesign - Process awareness and monitoring - BPM as an Enterprise Capability, BPM Maturity Models
Prerequisites	Process modeling with Academic Signavio
Assessment Methods	- Creation of process Manual and Business Management Manual - Online Tests (closed book) - Presentations
Recommended Reading and Material	- Dumas,M.; La Rosa, M.; Mendling, J.; Reijers, H.A., 2018. Fundamentals of Business Process Management. Springer. - Slides - Scripts
Attendance	mandatory
Comments	

IT Security Basics

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The course offers an overview of the fundamentals of IT security and deals with cryptographic methods, authenticity, key management, access control and secure communication.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to name the protection goals of IT security and to show threats as well as methods to guarantee the goals - know cryptographic methods and can name their respective strengths and weaknesses and thus possible application scenarios - Encrypt and sign emails and any documents - List methods for access control and monitoring at network, system and application levels and explain their function and application scenarios - Can explain basic technologies for secure communication - Explain basic procedures for evaluating the importance of systems or for risk analysis
Course contents	- Basics of Information Security - Threat to IT security and sources of danger (internal and external threats) - Basics of cryptography - HMAC - Public key infrastructures (PKI) - Signatures - Certificates - access control - Identification/Authentication/Authorization - Password security/entropy - DMZ, Firewall & IDS/IPS - IPSec - Transport Layer Security - Secure communication mechanisms
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

IT-Based Controlling

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Assessment Methods	
Recommended Reading and Material	- SAML Specifications 2.1 - OAuth 2.0 Autorization Framework - RFC6749 - OWASP 10 2021++/-- - NIST Secure Software Development Framework - OWASP Secure Coding Guideline
Attendance	
Comments	

Software Quality & DevOps

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The fourth part of the specialization "UX & Software Quality Assurance" adresses software quality management and deployment.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - discuss basics of quality criteria - apply quality measures in practice

	- explain quality standards (e.g. IEEE) and apply aspects of them - Visualize core software quality criteria for decision making - assess the importance of software - carry out a risk assessment for software projects - explain the principles and advantages of devops and the relationship to quality management - Discuss culturall aspects of devops (communication, collaboration, integration, automatisation) - practice roles, teams and project structures related to DevOps - Plan steps for the implementation of DevOps in a use case
Course contents	- quality management - quality standards - risk assessment - DevOps
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

IT Infrastructure

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course tackles important infrastructure (Hardware and Software) for digital Enterprises, ranging from computing centers to smart devices while focusing on selection, planning and rollout of this infrastructure.
Teaching methods	

Learning outcome	After passing this course successfully students are able to ... - assess basic concepts of virtualization and container technologies - plan a redundant computing center and the required hardware - automate the rollout of infrastructure using Infrastruce as Code (IaC) and document and monitor it using a coinfiguration managment data base (CMDB) - define criteria for hardware tender procedures - describe use cases for smart devices in companies
Course contents	- Data Center Basics - Server, Storage and Networking hardware and protocols - Scalability and Redundancy - Virtualization and different hypervisors, Virtual Machines vs. Container technologies - Infrastructure as Code (IaC) and configuration management, CMDBs and IT documentation, Monitoring - Smart Devices and equipment (e.g., cameras, drones, sensors) - Hardware procurement - Planning, Design and Rollout of enterprise IT infrastructure
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Cloud Computing

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course gives an overview on technical, managerial and legal aspects of cloud computing and enables planning, implementation and evaluation of native cloud- and migration projects, as well as the implementation of simple cloud applications.

Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - evaluate pros and cons of various deployment models (on premise vs. diverse cloud alternatives) and choose the best one for a project - evaluate Cloud Service Providers and applications according to suitable criteria, carry out a TCO calculation and select the best solution - configure and monitor several instances in a public cloud environment - develop owh applications in a Platform as a Service (PaaS) context
Course contents	- Cloud Computing NIST definition, architecture and deployment models - Cloud Computing NIST definition, architecture and deployment models - Hybrid Cloud Solutions - Cloud Computing platforms & applications, basics of Cloud Application Development - Economic aspects of Cloud Computing, Outsourcing, TCO calculations - Legal aspects, cloud standards - Selection of CSPs, Vendor Lock-In
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Data Science Engineering

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The third part of the specialization "Big Data & Data Science" introduces data engineering and data visualization
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - import raw data from various sources (data bases, internet) in various formats - preprocess raw data for further processing - critically assess diagrams - visualize data for exploration - create interactive graphics
Course contents	- create data science projects using R studio - manipulate data with the R tidyverse framework - Fundamentals of visualization - create meaningful diagrams using ggplot2 - create interactive diagrams
Prerequisites	Course: "Applied Probability and Statistics"Course: "Applied Statistics and Data Analysis"
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Creativity & Complexity

Degree programme	BWI
Semester	5
Course methods	UE
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	This course introduces the process of finding ideas by testing various creativity techniques, whereby the students also act as moderators using appropriate moderation techniques. As part of the course, students deal with the phenomenon of "complexity", develop a systemic attitude and train the explanation of complex issues,

	especially for people without major technical expertise.
Teaching methods	Impulse lecture, self-study (short videos, literature, etc.), discussion, work in groups, presentation
Learning outcome	After passing this course successfully students are able to ... - moderate a map query followed by clustering and multi-point querying - Implement case-oriented approaches to the generation of ideas (e. g. lateral thinking, critical thinking) as well as selected creativity techniques (e. g. stimulus word analysis, morphological box) to be explained and applied) - adopt a systemic mindset and explain and apply tools for dealing with complexity (cf. B. Effectiveness structures, paper computers - explain complex technical issues in a target group-specific manner (also for non-technicians)
Course contents	- Moderation of groups - Brainstorming and creativity - Networked thinking, dealing with complexity - Explain complex issues
Prerequisites	none
Assessment Methods	- Exercise, case studies, test
Recommended Reading and Material	- Dörner, Dietrich: Die Logik des Misslingens: Strategisches Denken in komplexen Situationen, 14. Aufl. 2003 - Lehner, Martin: Erklären und Verstehen, 2018 (e-Book) - Rustler, Florian: Denkwerkzeuge der Kreativität und Innovation – Das kleine Handbuch der Innovationsmethoden, 9. Aufl. 2019 - Schilling, Gert: Moderation von Gruppen, 2005 - Vester, Frederic: Die Kunst vernetzt zu denken, 2002
Attendance	Attendance is compulsory according to the statutes
Comments	none

Software Engineering Project

Degree programme	BWI
Semester	5
Course methods	PRJ
Language	English
ECTS Credits	5.00

Incoming places	Limited
Course description	In this project course, students practice the main phases of the software lifecycle (requirements engineering, software design, implementation, testing, deployment).
Teaching methods	project course applying agile approaches
Learning outcome	After passing this course successfully students are able to ... - collect software requirements and manage them in tools - derive software design from software requirements and create software specifications - implement and test software according to a software design and deploy the solution - work in independent and self-responsible teams and coordinate tasks - plan and implement a small-scale agile software development project involving stakeholders - create a product/sales presentation for a software solution
Course contents	- Integration of skills from previous courses in the studies - agile project management
Prerequisites	Software Lifecycle Management;Agile Project Management;Structured and OO Programming;Software Architectures;Distributed Systems;Data Management
Assessment Methods	- There are three top grading categories (Process, Solution, Reflection) with sub-categories, each of the top categories must be passed (>=50%) separately
Recommended Reading and Material	
Attendance	Attendance at project meetings is mandatory.
Comments	

Scientific Writing and Research Methods

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English

ECTS Credits	3.00
Incoming places	Limited
Course description	The course prepares students for writing scientific papers, especially the bachelor thesis.
Teaching methods	The integrated course consists of three parts: The self-study phase teaches basic research methods. This is consolidated further in class through practical exercises. In addition, the writing phase offers the opportunity to implement the acquired knowledge in the form of a seminar paper.
Learning outcome	After passing this course successfully students are able to ... - explain the standards that characterize scientific work. - formulate research questions and hypotheses. - select and apply methods for the chosen questions - structure a scientific paper in a formally correct manner. - write a proposal (exposé, disposition) for a seminar or bachelor thesis. - conduct (literature) research, to evaluate sources and to cite according to scientific standards. - explain formal and linguistic demands on a scientific text and to implement them in the writing phase.
Course contents	- Criteria of correct scientific conduct - Methods and theories of gaining knowledge - Structuring and composition of scientific work - Guidelines for ensuring good scientific practice - Research questions - their formulation, operationalization - Strategies of source acquisition - Documentation of sources - Proposal (exposé, disposition) - Scientific writing style and basic features of argumentation - Formal design of academic papers
Prerequisites	none
Assessment Methods	- Ongoing performance review through mini-tests and written assignments
Recommended Reading and Material	- Leedy, P.D. & Ormrod, J.E., 2015. Practical research. Planning and design 11 Aufl., Harlow, GB: Pearson Education. - Skern, T., 2019. Writing scientific English. A workbook, Stuttgart: UTB. - Theuerkauf, J., 2012. Schreiben im Ingenieurstudium. Effektiv und

	effizient zur Bachelor-, Master- und Doktorarbeit, Paderborn: Schöningh.
Attendance	100%
Comments	

Software Security

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Software security is the umbrella term for software designed to continue to function properly in the face of malicious attacks. Security as part of the software development process is an ongoing process involving people and processes that ensures the confidentiality, integrity and availability of the application. Secure software is the result of security conscious software development processes where security is built in and therefore software is developed with security in mind
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - Establish identity & access management in (web) applications - Recognize the 10 most common security vulnerabilities in software - Use established authentication methods (HTTP Digest, Single Sign On/SAML/OAuth2) - Development of secure applications and assessment of current security risks - Evaluate software projects using a Secure Software Lifecycle - Assessment of threats to applications using a risk matrix - Basics for conducting a security assessment / pentest - Software development: Secure by design, secure by default
Course contents	- Application Security - Secure by design principles - Secure authentication in SW

	- Web Application Security - Identity & Access Management - Risikobewertung in SW / Threat Modeling - DB Security
Prerequisites	Knowledge of common web languages (HTML, JS, CSS, PHP, AJAX)Knowledge of object-oriented languages (Java || C#. / .net)Knowledge of handling databases (mySQL or Oracle)Basic knowledge of using LinuxKnowledge of network protocols: Ethernet, IP/ARP, TCP/UDP, DNS, Application Layer protocols, Transport Layer Security or http/s, s/ftp, ssh,...
Assessment Methods	
Recommended Reading and Material	- SAML Specifications 2.1 - OAuth 2.0 Autorization Framework - RFC6749 - OWASP 10 2021++/-- - NIST Secure Software Development Framework - OWASP Secure Coding Guideline
Attendance	
Comments	

Rapid Application Development

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The fourth part of the specialization "Business Applications" tackles the tool-based development of data base-intensive applications.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - assess the advantage of No-Code/Low-Code applications vs. classic software development - identify use cases for No-Code/Low-Code - Choose a suitable NCLC development platform - Using some platform (e.g., MS Power Apps), create simple

	business applications - Apply security mechanisms - Integrate the application with existing systems using interfaces
Course contents	- No-Code and Low-Code development platforms - Functions of Appluication Builder - Integration of DB applications into existing infrastructure - security aspects
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Backend Web Engineering

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course enables students to develop (mobile) web applications using current frontend web frameworks. Relevant web frameworks (such as Spring Boot, Symfony and FLASK) will first be presented, and an own project using Spring Boot implemented based on the framework-specific design and architectural principles. A REST-API will be implemented and authorized through JWT. Main focus will be given to practical work.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - plan and implement dynamic web applications using server-side programming (using Spring Boot) - use general concepts of server-side implementation (sessions, data transmission, authentification) for own projects - implement and link data bases to web applications

	- implement data exchange between client and server using Ajax and JSON - implement maintainable software using selected frontend frameworks
Course contents	- Base technologies of webserver infrastructure - Fundamentals of server-side programming (sessions, cookies, data exchange) - Java Spring Boot Programming - Interfacing Data Bases - Provision of Restful Web Services
Prerequisites	Structured and OO Programming; Data Management; Web Engineering
Assessment Methods	- Project Work
Recommended Reading and Material	
Attendance	mandatory
Comments	

Frontend Web Engineering

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course enables students to develop (mobile) web applications using current frontend web frameworks. Relevant web frameworks (such as React, Angular and Vue.js) will first be presented, and an own project using Vue.js implemented based on the framework-specific design and architectural principles. The integration with a REST-API will be implemented using Ajax; JSON will be used for data exchange. Main focus will be given to practical work.
Teaching methods	Short presentations; project work; self-study with practical examples; coaching.
Learning outcome	After passing this course successfully students are able to ...

	- give an overview of relevant frontend web frameworks and discuss pros and cons - implement maintainable software using selected frontend frameworks - implement data exchange between client and server using Ajax and JSON - explain the architecture and the design principles of specific frameworks and to apply them in SW development - deploy the implemented software
Course contents	- overview on relevant frontend frameworks - architecture and design principles of selected frameworks - components of a selected framework - programming using a selected framework
Prerequisites	Structured and OO Programming; Data Management; Web Engineering
Assessment Methods	- Project Work
Recommended Reading and Material	
Attendance	mandatory
Comments	

Agile Software Testing

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The third part of the specialization "UX & Software Quality Assurance" tackles Software Testing in an agile setting.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe and use proper software testing terminology - describe the fundamental testing process and actively apply from a users' perspective

	- describe and apply IT standards of software testing (e.g., IEEE 829) - apply fundamental testing methods - plan and carry out simple test automatization using unit tests and UI-driven development - explain principles of agile sofware development - explain the challenges of testing and quality assurance in agile projects - carry out and support suitable testing activities in agile teams
Course contents	- testing principles - testing planning - testing - testing documentation - agile methods of testing
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Machine Learning

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The fourth part of the specialization "Big Data & Data Science" focuses on Machine Learning.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - fit machine learning models (supervised, unsupervised) to data - assess and compare the performance of predictive models

	- get into new data science topics
Course contents	- Supervised Learning: Trees, Neural Networks, k-NN, Naive Bayes - Unsupervised Learning: PCA, Medoid-Based Clustering, Association Rules - Benchmarking and Tunining of machine learning algorithms - Special Topics (Text Mining, Network Analysis)
Prerequisites	Course: "Data Engineering"; Course: "Applied Probability and Statistics";Course: "Applied Statistics and Data Analysis";Course: "Introduction to Statistical Learning"
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

International Business Engineering (BIW)

Manufacturing Engineering

Degree programme	BIW
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course students acquire basic knowledge in the fields of production engineering according to DIN 8580
Teaching methods	Integrated course
Learning outcome	After passing this course successfully students are able to ... - to specify essential industrial requirements formanufacturing processes using appropriate technical parameters - to explain selected manufacturing processes from the main groups mentioned in DIN 8580 with regard to basic physical or chemical principles, typical industrial process steps and devices as well as

	common industrial applications - describe a manufacturing process using one or more of these methods by means of the underlying process flow logic (material flow)
Course contents	- Requirements for industrial manufacturing processes (incl. measured variables) - Overview of main groups of manufacturing processes (DIN8580)
Prerequisites	Basic knowledge according to admission requirements for the bachelor's program
Assessment Methods	- Participation, Moodle tests and final examination
Recommended Reading and Material	- Förster, R.; Förster, A.: Einführung in die Fertigungstechnik, Springer Vieweg, 2018
Attendance	75%
Comments	none

Materials Science

Degree programme	BIW
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course you will get an overview of the most important materials of our everyday life - have an insight into atomic levels, learn what these materials are capable of and what we use them for. Learn how to select the right material for a product design and carry out proper material tests in the laboratory course!
Teaching methods	Our course consists of two sessions: the class and the self-study. During each class you will get information about some topics about material science.During the self-study you have to learn by yourself some additional information about materials. During some classes, you will have to write a test. The test will include the chapters, which were discussed during the class, as well as the chapters you had to learn during your self-study. After having 4 classes and 4 self study sessions, you will attend a laboratory course, where you will carry out

	by yourself material tests.
Learning outcome	After passing this course successfully students are able to ... - to explain the basic properties of metallic materials (steel, cast iron, aluminium, copper, titanium, magnesium and their alloys) from a scientific and technical point of view, using practical industrial examples - explain the basics of microscopy and electron microscopy - to be able to make a simple material selection of metals - To be able to name metallic materials. - be able to enumerate metallic materials compared to plastics and ceramics as well as composite materials with advantages and disadvantages - explain the basics of mechanical methods for testing materials as well as selected concrete test methods using appropriate technical terms and quantities (tensile test, hardness test, Charpy, Wöhler)
Course contents	- Terms (e.g. thermal expansion, modulus of elasticity, ...) and material properties - Atomic decomposition & periodic table, chemical bonds - Structure of metals (krz, kfz, hdp) - Iron-carbon diagram - Steel and cast iron - Aluminium materials - Copper Materials - Titanium materials - Magnesium materials - Alloys, phase diagrams - Electrochemistry especially corrosion of metallic materials - Mechanical test methods (tensile test, notched bar impact bending test, hardness test, Wöhler test), PT, MT, VT; UT. - effects of mechanical stress (e.g. deformation, work hardening) - Interaction of material and production technology, example forging - Basic principles of material selection (presentation of software tools) - Differences of the material classes (metals, plastics, ceramics) - Electron microscopic examination of various materials
Prerequisites	English language skills
Assessment Methods	- Written exam (Online)
Recommended Reading and Material	- Ashby, M.F.; Jones, D.R.H.: Engineering Materials 1: An Introduction to Properties, Applications and Design, Elsevier, 2011
Attendance	75%

Comments	More detailed information can be found in the Moodle course.

Technical English

Degree programme	BIW
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)

Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Industrial Informatics in a Digital Economy

Degree programme	BIW
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	After presentation of basic principles of Computer Science and Software Engineering they will be applied on sample applications of Digitization in concrete industrial environments (Software 4.0).
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to apply basic principles of Computer Science and Software Engineering in industrial problem fields and projects - to adopt Requirements Engineering and Software Modeling for structured analysis and design - to elaborate sample applications of Digitization in a concrete environment - to identify, evaluate, select and introduce (Software) systems for industrial applications (using methodologic approaches for selecting appropriate options) - to understand principles of Software 4.0 (including Security & Safety), to apply adequate methods and to implement software solutions in industry
Course contents	- Computer Science Basics - Software Engineering - Software Life Cycle - Process models to develop Software (V-Model XT, Agile,...) - DevOps (Operationalization of Software)

- Requirements Engineering & Software Modeling
- Software 4.0
- Digital Transformation in industry
- Reference architecture RAMI 4.
- Interoperability
- Security & Safety

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments none

Circular Economy and Sustainability

Degree programme BIW

Semester 5

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description In this course students deal with sustainable circular economy and apply the know-how to production technology.

Teaching methods

Learning outcome After passing this course successfully students are able to ...
- understand the fundamental concepts of sustainability; to be able to develop assessment criteria for monitoring sustainable development
- recognise the development and concept of circular economy; to aquire the professional vocabulary to develop a corporate culture of sustainability
- know about legal fundamentals at a European and national level
- be able to explain how a circular economy differs from the current linear system; to be able to explain how an economically successful transition to a circular design is developed
- be able to classify the differences between "reuse", "remanufacturing" and "recycling" principles

	- be able to explain the waste hierarchy and principles of waste prevention ("reduce") and Life Cycle Assessments (LCA) - be able to plan and implement sustainable business models for circular economy - understand the importance of engineers with regard to sustainable product design - understand the need to adapt marketing and sales strategies for the circular economy - be able to explain the international cycle of primary and secondary metal and raw material flows and the importance of anthropogenic deposits ("urban mining") - be able to explain the principles of non-financial reporting by companies within the framework of the CSR Directive (Corporate Sustainability Reporting Directive) of the EU - have an overview of sustainable financing models for companies and taxonomy.
Course contents	- Concept of sustainability - Policies for sustainable and circular economy - From linear to a circular economy (CE) - Closing loops for a CE - Business models for a CE - Concepts for circular product design - Thinking in global systems - Green governance and sustainable finance
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Sustainable Environmental and Bioprocess Engineering (BUB)

Sustainable Environmental and Bioprocess Engineering

Degree programme	BUB
Semester	3

Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course "Sustainable Environmental and Bioprocess Engineering" offers a comprehensive introduction to sustainable environmental and bioprocess engineering. Students acquire knowledge of bioreactors, process control, quality assurance in biotechnological processes as well as in environmental compartments, wastewater treatment and air pollution control. Practical examples from industry and current trends provide clear insights into the fields of application and developments in sustainable environmental and bioprocess technology. In addition, the course supports students in deciding on a further specialization from the 4th semester onwards.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - understand the basic principles of sustainable environmental and bioprocess engineering. - understand and analyze challenges in the fields of bioprocess engineering and environmental engineering.
Course contents	- Bioprocess technology: Basics of sustainable bioprocess technology; bioreactor design and process control; quality assurance in biotechnological processes; industrial applications and trends in sustainable bioprocess technology - Environmental technology: quality of environmental compartments: pollutants in water, air and soil; wastewater treatment; air pollution control; environmental law and requirements
Prerequisites	
Assessment Methods	- LV-immanent and final exam
Recommended Reading and Material	- Pauline M. Doran: Bioprocess Engineering Principles. Elsevier Science & Technology Books 2 (2013) - Bruce Rittmann und Perry McCarty: Environmental Biotechnology: Principles and Applications (2001)
Attendance	75% attendance compulsory
Comments	

Technical English

Degree programme	BUB
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	- Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	- Vocabulary Test (10%) - Self-Study and Class Preparation (30%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag.

- Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.

Attendance Obligatory

Comments

Master DEGREE PROGRAMS

Data Science (MDS)

Artificial Intelligence

Degree programme	MDS
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This module introduces computational methods of Artificial Intelligence.
Teaching methods	Presentations, Exercises.
Learning outcome	After passing this course successfully students are able to ... - give an overview on main directions in Artificial Intelligence, their applications and potentials/limitations - do logic reasoning using propositional und First-Order-Logic, as well as reasoning under uncertainty, to solve simple tasks with numerical,sequential, hierarchical or geographic data. - select and implement strategies for searching, games and problem solving, and to evaluate their time and space complexity. - apply methods based on reenforcement learning for speech recognition - explain deep learning networks (e.g., convolutional and recurrent neural networks) for pattern recognition problems - explain Bayesian Belief Networks and apply them for predicitions - adapt and apply ready-made scripts to carry out complex tasks in the field of Artificial Intelligence
Course contents	- Foundations, directions and applications of AI - Logic and reasoning under uncertainty - Searching, Games and Problem Solving - Neural Networks and Deep Learning - Reenforcement Learning - Advanced topics of Statistical & Machine Learning - Computer Linguistics

Prerequisites	Machine LearningAlgorithms & Data Structures
Assessment Methods	- Übungen - Abschlussklasur
Recommended Reading and Material	- Ertel, W., 2016. Grundkurs Künstliche Intelligenz: Eine praxisorientierte Einführung. 4. Auflage. Springer Vieweg. - Russel, Norvig, 2015. Artificial Intelligence: A Modern Approach, Pearson.
Attendance	Not mandatory, except for the final exam.
Comments	

Data Science Law

Degree programme	MDS
Semester	3
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This course focuses on data science-relevant law topics, in particular EU regulations.
Teaching methods	Lectures, Cases, Discussion.
Learning outcome	After passing this course successfully students are able to ... - give an overview on law topics relevant for data scientists - identify potential legal risks in the daily work - advise collegues regarding data law regulations
Course contents	- General Data Protection Regulation - Data Act - Data Governance Act - AI Act
Prerequisites	Principles of Public Law
Assessment Methods	- Exam - In-Class participation - Home Work
Recommended Reading and Material	

Attendance	Mandatory
Comments	

Data Science Ethics

Degree programme	MDS
Semester	3
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Discussion of ethical principles concerning data science
Teaching methods	Lectures, Discussions
Learning outcome	After passing this course successfully students are able to ... - discuss ethical issues regarding typical tasks of a data scientist
Course contents	- Ethical issues regarding data collection and data manipulation
Prerequisites	None
Assessment Methods	- Discussion paper - In-Class participation
Recommended Reading and Material	
Attendance	Mandatory
Comments	

Applied Mathematics

Degree programme	MDS
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The course "Applied Mathematics" aims to convey fundamental mathematical concepts and methods needed in the context of Data Science, particularly in relation to optimization.
Teaching methods	Lecture and exercises.
Learning outcome	After passing this course successfully students are able to ... - explain fundamental concepts and methods of linear algebra, particularly in relation to inner products, orthogonality, eigenvalue theory, and linear optimization, and apply them in the context of Data Science. - explain fundamental concepts and methods of multivariable calculus, especially gradient descent methods and optimization with constraints, and apply them in the context of Data Science.
Course contents	- Linear Algebra: inner product, orthogonality; eigenvalue and singular value decomposition; linear optimization. - Analysis of multivariable functions: partial derivatives, total differentiability; gradients, directional derivative, linear and quadratic approximation, local extrema; optimization methods: gradient descent methods, Lagrange method.
Prerequisites	Basic knowledge of calculus and linear algebra (see compensatory modules).
Assessment Methods	- The performance assessment takes place during the course and in the module examination.
Recommended Reading and Material	- Will be provided in the course.
Attendance	Attendance is mandatory.
Comments	

Statistical Computing

Degree programme	MDS
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	R is not only an environment for statistical computing and graphics, it is also a full programming language.Hence, users are not limited to the mere execution of ready-made commands, but can write their own functions if additional functionality is needed. Apart from that, this course imparts knowledge about the different data structures used in R as well as functions that operate on them. This allows for an efficient generation of the desired output, e.g., custom-made summary statistics, visualizations and models. Furthermore, a selection of important statistical or R-specific topics will be covered, including design matrices and contrasts, R's formula interface, the role of matrix decomposition techniques in statistics etc.
Teaching methods	Both classroom teaching (lecture, practical exercises, discussion) and self-study (preparation and post-processing) are integrated
Learning outcome	After passing this course successfully students are able to ... - generate dynamic documents - manage data using the available data structures - use elements of structured programming - apply object-oriented concepts - create and interpret graphics - manage packages, measure performance and do profiling - perform in-depth regression analysis - apply selected time series analysis methods
Course contents	- R Markdown, Quarto, TinyTeX - Vectors, matrices, arrays, data frames, lists - Strings and factors - Missing values - Loops, conditions, functionals (apply and friends), vectorization - Working with functions, defining new functions, passing functions to other functions - Object-oriented systems: Base types, S3, S4, RC - Base graphics - Grid graphics: Lattice - Measuring speed and memory usage - Categorical predictors in linear regression - Analysis of variance, analysis of covariance - Effect plots, Parallel coordinates, Biplots - Formulas: Intercept, main effects and interactions, formula operators - Contrasts: Coding schemes, planned contrasts, post hoc contrasts - Diagnostics: Non-normality, nonlinearity, heteroscedasticity, regression outliers, leverage values and influental observations,

	multicollinearity - Transformations of predictors and/or response - Local regression, nonlinear regression, regression splines - Model selection and validation - Long-term forecasts (using regression), ARIMA models
Prerequisites	Basics of Probability and Statistics (as taught in the bridging courses)Applied Statistics (as taught in the bridging courses)
Assessment Methods	- Partial Exams throughout the semester - In-Class participation - Project
Recommended Reading and Material	- Wickham, 2019: Advanced R. CRC Press. - Faraway, 2014: Linear Models with R (Second Edition). CRC Press.
Attendance	mandatory
Comments	

Data Engineering

Degree programme	MDS
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course addresses the practical challenges of one of the main process steps in a data science project: the data engineering, both in R and Python.
Teaching methods	WorkshopsDiscussionExercises
Learning outcome	After passing this course successfully students are able to ... - describe the workflow of a data science project - access various data sources for data import (e.g., relational data bases, web data, text, pictures, videos, streams) - perform data wrangling (import, tidy, transform) - explore and visualize data - assess data plausibility and quality - use relevant tools such as TidyVerse (R) and Pandas (Python) - assess the usefullness of R and Python

Course contents	- Design of Data Science Projects - Data formats for structured and unstructured data (in particular data frames) - data import, data cleansing - data visualization - TidyVerse, ggplot2; Pandas, Numpy - Compare R and Python
Prerequisites	Scripting with R and Python, Descriptive Statistics
Assessment Methods	- Continuous assessment and final project
Recommended Reading and Material	- Grolemund, Wickham, 2016. R for Data Science, O'Reilly - Baumer, Kaplan, Horton, 2017. Modern Data Science with R. CRC Press. - VanderPlas, 2017. Python Data Science Handbook. O'Reilly
Attendance	Attendance is mandatory
Comments	

Data Science Infrastructure

Degree programme	MDS
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course addresses aspects of ICT infrastructure that is relevant for Data Science activities. Besides getting an overview of computational problems and technologies in the scope of Data Science, course participants will learn how to store and process the different types of data with state-of-the-art software tools and libraries. Amongst others, topics include different kind of data storages (NoSQL databases, hdfs), computing techniques (Python packages, Hadoop, Spark), performance optimization, stream data processing, or the utilization of cloud services for Big Data.
Teaching methods	In the on-site sessions, brief lectures on the specific topics are given. Students need to prepare for each session in which hands-on skills are practiced. In further consequences, these computing infrastructure skills should be applied in a group project. At the end of

	the course, each participant must pass a practical task in form of a computer-based exam.
Learning outcome	After passing this course successfully students are able to ... - give an overview of computational problems in the field of Data Science and explain relevant technologies in this context. - store and access structured, semi-structured as well as unstructured data with NoSQL database technologies. - run data-based computations on one or more processors and using different Python libraries (pytorch, sklearn, mxnet, tensorflow). - give an overview of dimensions and challenges of Big Data as well as store and process data in a distributed manner using the Hadoop ecosystem (hdfs, map/reduce). - configure a Spark cluster and measure performance improvements of machine learning algorithms executed on such an infrastructure. - manage and process data streams, such as sensor data, using InfluxDB, Kafka and Spark. - utilize cloud services to store, process and exploit Big Data.
Course contents	- Computing Infrastructure for Data Science - Data Storage: From Databases to Data Lakes - Data Processing: From distributed computing to machine learning frameworks - Big Data (Hadoop) - Analytics Engine (Spark) - Stream Data Processing (InfluxDB, Kafka) - Cloud Services for Big Data
Prerequisites	Databases (SQL, NoSQL)Programming (Python/R)Operating Systems (Linux)
Assessment Methods	- Weekly Moodle quizzes to assess subject matter knowledge (20%) - Computer-based exam to assess hand-on skills (40%) - Group-based project on a realistic scenario (40%)
Recommended Reading and Material	- White, 2015. Hadoop: The Definitive Guide, O'Reilly - Seidman, Shapira, Malaska, Grover, 2015. Hadoop Application Architectures. - Vohra, 2016. Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools, Apress - Simon, 2015. Too Big To Ignore: The Business Case for Big Data , Wiley - Kleppmann, 2017. Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems, O'Reilly - Harrisons Guy, 2015, Next Generation Databases: NoSQL,

	NewSQL, and Big Data, Apress
Attendance	Attendance is mandatory
Comments	

Analysis

Degree programme	MDS
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Linear Algebra

Degree programme	MDS
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this lecture, the main concepts of linear algebra are introduced.

Teaching methods	Lectures are split into a typical lecture and then a round of presentations of exercises, following the principles of the "inverted classroom".This means that, before lecture, students are to become familiar with topics by reading the recommended references and by preparing short presentations for lecture of solutions to exercises. In the lectures, discussion will revolve around the students' questions and developing a deeper insight into the topics.Within a week after each lecture, homework exercises will be due.
Learning outcome	After passing this course successfully students are able to ... - solve elementary problems in vectors spaces as well as simple geometric tasks in two- and three-dimensional euclidean space. - make basic matrix calculations, work with linear maps and calculate determinants and inverse matrices. - solve systems of linear equations via matrices and the Gaussian algorithm.
Course contents	- vector spaces - matrices and linear maps - systems of linear equations
Prerequisites	A-Levels
Assessment Methods	- Grading has two parts: - 1. Assessment during the course: - a) presentations in lecture, 14% - b) homework, 36% - 2. exam: 50% - For passing the course at least 50% of the points (individually!) in each part must be reached.
Recommended Reading and Material	- J. Hefferon, Linear Algebra, 4th Edition. - H. Anton & A. Kaul, Elementary Linear Algebra, 12th Edition, 2019, Wiley. - S. Axler, Linear Algebra Done Right, 4th Edition, 2024, Springer Verlag.
Attendance	Compulsory attendance of at least two of the three lectures.
Comments	

Applied Statistics

Degree programme	MDS
Semester	1
Course methods	ILV

Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	“Angewandte Statistik” is targeted on providing a hands-on introduction to the applied analysis of empirical data. Students will gain an understanding of the need to be able to select the correct statistical method for a given problem, and will learn how to execute the corresponding analysis step by step, i. e., reading and manipulating data as well as applying descriptive and inferential statistical methods. A special focus is on the interpretation and communication of analysis results by means of statistical reports. The "Literate programming"-approach guarantees the reproducibility of results, imperative in modern research. In order to show that data used for statistical analyses are the result of a structured process, the course also covers the main features of empirical social research.
Teaching methods	Both face-to-face learning (lecturing, computer-based practical exercises) and self-study (preparation and post-processing) are integrated.
Learning outcome	After passing this course successfully students are able to ... - explain main tasks of statistics and relate them to real-world tasks. - understand mode of operation and requirements of empirical social research. - preprocess, describe and visualize data in R. - carry out hypothesis tests for categorical and metric variables. - test associations between two categorical or two metric variables. - establish and check regression model for metric variables. - perform basic time series analyses.
Course contents	- fundamentals of empirical social research (design, sampling) - data management in R - one categorical variable: absolute and relative frequencies, bar charts, chi-squared test - two categorical variables: contingency tables, grouped bar charts, spine plots, chi-squared tests for independence and homogeneity - one metric variable: histogram, indicators for mean and variance, boxplots, t-test - two metric variables: scatter plot, correlation analysis, regression analysis - time series analysis: time series plots, regression models, naive

	forecasting - Reproducible Scientific Research: Literate Programming using R Markdown - choosing the appropriate statistical method for a given problem
Prerequisites	Applied Probability Calculus and Statistics (in particular: distributions, confidence intervals and statistical tests)
Assessment Methods	- In-class exercises, - final exam
Recommended Reading and Material	- Lecture notes - Hatzinger, Hornik, K., Nagel, H., & Maier, M. J. (2014). R - Einführung durch angewandte Statistik (2., aktualisierte Auflage.). Pearson Deutschland.
Attendance	75%
Comments	

AI Engineering (MAI)

Machine Learning 1: Basics

Degree programme	MAI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	In this course the theoretical and applied basics of machine learning shall be taught.
Teaching methods	A combination of lectures and tutorials
Learning outcome	After passing this course successfully students are able to ... - self implement selected algorithms - explore data and perform analysis - analysis according to principles of machine learning (e.g. Cross Validation, Parameter Tuning) - applied tasks of machine learning (regression, classification, clustering)

	- possibilities and limitations of machine learning
Course contents	- Basic principles: Classification, Regression, Clustering, Over/-Underfitting, Cross Validation & Performance Evaluation, Parameter Tuning; - Data handling: Data Cleaning, Handling Missing Values, Data Normalization, Class Balancing, Feature Selection, Dimensionality Reduction; - Algorithms: kNN, Linear Regression, K-Means, Hierarchical Clustering, Trees, principal component analysis, ANN
Prerequisites	Python and basics of statistics and mathematics
Assessment Methods	- 70% exam - 30% assignments
Recommended Reading and Material	- James G., Witten D., Hastie T., Tibshirani R. (2017): An Introduction to Statistical Learning. – Springer. - Marsland S. (2015): Machine Learning, An Algorithmic Perspective. – CRC Press. - Géron A. (2017): Hands-On Machine Learning with Scikit-Learn & TensorFlow. – O'Reilly.
Attendance	75%
Comments	

Advanced Game Design

Degree programme	MAI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Advanced Game Design introduces and develops the theory & practice of designing videogames - drawing on experiences from industry veterans.
Teaching methods	Lectures, Workshops, and Coursework.
Learning outcome	After passing this course successfully students are able to ...
Course contents	- Formal and Dramatic Elements of Games - History of Games

	- Design Tools and Methods - World and Level Design - Paper Prototyping
Prerequisites	
Assessment Methods	- Paper Prototype Workshop - High Concept Coursework
Recommended Reading and Material	- Theory of Fun for Game Design by Raph Koster - Game Design Workshop by Tracy Fullerton - Rules of Play: Game Design Fundamentals by by Katie Salen and Eric Zimmerman
Attendance	
Comments	

Quantum Engineering (MQE)

Team Performance and Leadership

Degree programme	MQE
Semester	1
Course methods	UE
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course will provide an overview of the latest practical and theoretical leadership concepts. Students will gain practical insights into the challenges of leadership and transformation, for example, in international organizations, and they will also develop new perspectives on the contemporary world of work and the theme of leadership. One of the course's fundamental components will be a student created reflection on specific issues concerning leadership and their implementation.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	None

Assessment Methods	- Immanent performance assessment (participation in workshops, exercises, case studies, written exam)
Recommended Reading and Material	- Current scientific literature and specialist articles - Presentations and scripts
Attendance	
Comments	

Homologation Electronics

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	This course is dedicated to students who have a degree in computer science. It conveys fundamental concepts electronic engineering which are prerequisite for the subsequent course program.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	None
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Wilfried Weißgerber, Elektrotechnik für Ingenieure 1, Springer Verlag, 2018 - Thomas Harriehausen · Dieter Schwarzenau, Moeller Grundlagen der Elektrotechnik, Springer Verlag, 2019 - M.Marinescu, J.Winter, Grundlagenwissen Elektrotechnik, Springer eBooks, Vieweg+Teubner, 2011 - https://link-1springer-1com-1000342cz0905.han.technikum-wien.at/book/10.1007/978-3-658-27840-3 - https://link-1springer-1com-1000342v0075f.han.technikum-wien.at/book/10.1007/978-3-658-21823-2
Attendance	

Comments

Quantum Programming Lab I

Degree programme	MQE
Semester	1
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The course complements quantum computing I and focuses on quantum algorithms for optimization problems and their implementation using qiskit.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	-fundamental principles of quantum information (QUINF1)-complex valued linear algebra (MAQE)-quantum gates and fundamental subroutines for quantum algorithms (QUCO1)
Assessment Methods	- Course-immanent performance assessment and final presentation
Recommended Reading and Material	- Nielsen & Chuang: Quantum Computation and Quantum Information - Johnston et al: Programming Quantum Computers
Attendance	
Comments	

Homologation Computer Science

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course is dedicated to students who do not have a degree in computer science. After introducing basic elements of Computer Science (Hardware, Software, networks, development methods and processes) basic programming techniques will be learnt and applied on single-chip-computers.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	None
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Christian Baun, Operating Systems / Betriebssysteme, DOI: 10.1007/978-3-658-29785-5 - Connor P. Milliken, Python Projects for Beginners – A Ten-Week Bootcamp Approach to Python Programming, DOI: 10.1007/978-1-4842-5355-7 - Sunil Kapil, Clean Python – Elegant Coding in Python, DOI: 10.1007/978-1-4842-4878-2 - Python® Notes for Professionals, https://books.goalkicker.com/PythonBook/ (free)
Attendance	
Comments	

Homologation Physics

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This course is dedicated to students who have a degree in computer science. It conveys fundamental concepts of physics and classical mechanics which are prerequisite for the subsequent course program.
Teaching methods	

Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	None
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Douglas. Giancoli, Physics for Scientists and Engineers, Global Edition, Pearson - Geoffrey Brooker: Modern classical optics, Oxford Univ. Press
Attendance	
Comments	

Mathematics for Quantum Engineering

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course content comprises concepts and methods of linear algebra as far as necessary for quantum engineering, the bra-ket-formalism, elements of probability theory, some basics of number theory, and the Fourier transform in the infinite dimensional context.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	None
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Jürgen Audretsch: Entangled Systems (WILEY-VCH, 2007), Chapter 1 and Section 12.6
Attendance	
Comments	

Quantum Computing I

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course introduces the basics of quantum computation and examplifies the principles in terms of the algorithms by Grover and Shor.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	-fundamental principles of quantum information (QUINF1)-complex valued linear algebra (MAQE)
Assessment Methods	- Course-immanent performance assessment and final presentation or final exam
Recommended Reading and Material	- Nielsen & Chuang: Quantum Computation and Quantum Information - Johnston et al: Programming Quantum Computers - Wong: Introduction to Classical and Quantum Computing - Aaronson: Quantum Computing since Democritus - Eleanor G. Rieffel and Wolfgang H. Polak: Quantum Computing, A Gentle Introduction
Attendance	
Comments	

Quantum Information I

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course students get acquainted with fundamental concepts of quantum information and the description of quantum states and their manipulation.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	-complex valued linear algebra including the Dirac notation (MAQE)-classical mechanics (HOPH)-ray and wave optics (HOPH)
Assessment Methods	- Course-immanent performance assessment and final exam
Recommended Reading and Material	- Stephen Barnett: Quantum Information - Nielsen & Chuang: Quantum Computation and Quantum Information - Audretsch: Verschränkte Systeme
Attendance	
Comments	

Enabling Technologies I

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	In this course students get acquainted with experimental techniques and devices required for manifacturing physical qubits.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	Basic linear algebra, physics and electronics (MAQE, HOEL, HOPH)
Assessment Methods	- Course-immanent performance assessment and final presentation
Recommended Reading and Material	- Bluhm, Hendrik. "3. Quantum computing, qubits and decoherence". Electrons in Solids: Mesoscopics, Photonics, Quantum Computing, Correlations, Topology, Berlin, Boston: De Gruyter, 2019, pp. 125-

204. https://doi.org/10.1515/9783110438321-003
- P. Krantz, M. Kjaergaard, F. Yan, T. P. Orlando, S. Gustavsson, W. D. Oliver; A quantum engineer's guide to superconducting qubits. Appl. Phys. Rev. 1 June 2019; 6 (2): 021318. https://doi.org/10.1063/1.5089550
- Nanoelectronics and Information Technology, Rainer Waser: Quantum Computing: Fundamentals and Solid-State Realizations, DiVincenzo, Ustinov, Schreiber, Vandersypen, WILEYVCH (2012), ISBN: 978-3-527-40927-3
- Physics of Cryogenics 1st Edition, 2017, by Bahman Zohuri, ISBN: 978-0-12-814519-7
- Pozar, D. M. (2012). Microwave Engineering. Italy: Wiley.

Attendance

Comments

Tissue Engineering and Regenerative Medicine (MTE)

Stem Cell Basics

Degree programme	MTE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Corporate Management

Degree programme	MTE
Semester	1
Course methods	SE
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	The course shall provide an overview over the essential elements of Management of companies, particularly in the Pharma industry, in

	order to prepare the students for managerial tasks in practical business life. After an introduction to basics of management (managers, environment, social responsibility) the course covers the 4 managerial steps Planning, Organizing, Leading and Control. The knowledge acquired in this course is a prerequisite for the course "Case Studies in Pharmaceutical Industry" in the 3rd semester.
Teaching methods	Lectures with Powerpoint Slides as well as discussions and several case studies.
Learning outcome	After passing this course successfully students are able to ... - define tasks and steps of the managerial process for companies as well as explain examples for “effective” and “efficient” management - analyze the economic situation of a company as a manager, for example by using comparative data in income statements - develop and define company goals as a manager - make decisions as a manager as well as to explain and justify them - recognize critical situations in terms of business ethics and develop solutions - explain methods how to motivate employees and evaluate their applicability in practical cases - evaluate various methods of communication for practical management - explain leadership styles and their advantages and disadvantages for specific situations and persons - recognize and apply suitable negotiation techniques and solutions for conflicts
Course contents	- Basics of management, decision making in business, planning, organizational structure and culture, change management, time management, managing teams, motivation of employees, leadership traits and styles, communication in business, negotiation, control of goal achievement, key factors of successful management
Prerequisites	
Assessment Methods	- Written final exam
Recommended Reading and Material	- Stephen P. Robbins, David A. DeCenzo, Mary CoulterFundamentals of ManagementPearson Education, 2019, 11th Global EditionISBN-10: 1292056541ISBN-13: 978-1292056548
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% you lose the first try in the exam.
Comments	

Molecular and Cellular Biology in Regenerative Medicine

Degree programme	MTE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Sustainability and Ethics in Work and Engineering

Degree programme	MTE
Semester	1
Course methods	SE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Biomaterials in Tissue Engineering

Degree programme	MTE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The students obtain knowledge medical applications of biomaterials as well as about basic concepts regarding design and mechanical properties of selected natural and synthetic biomaterials. Topics from current research projects of the UAS Tech are explained and discussed.
Teaching methods	- Lecture/Presentation- Discussion
Learning outcome	After passing this course successfully students are able to ... - describe the basic techniques to manufacture scaffolds from raw

	biomaterials and explain the different prerequisites for the biomaterials. - explain nature design concepts in the biomaterials field. - differentiate biomaterials regarding their properties and assess their usage in a specific application. - describe the most common techniques to test cell biocompatibility of biomaterials and apply them on different biomaterials. - correlate the protein structure of a biomaterial with its properties as a biomaterial.
Course contents	- Elements of biomaterials - Self-assembly and growth - Mechanical concepts in biomaterials - Different protein fibers: collagen, silk, keratin - Methods for the determination of biocompatibility - Soft tissue - skin - Cartilage - Biological composite materials e.g. fibers - Hierarchical design bone, wound care und suture materials, vascular implants, biomimetic and bio-inspired materials
Prerequisites	Basics of chemistry and protein chemistry
Assessment Methods	- Final exam
Recommended Reading and Material	- Gordana Vunjak-Novakovic, R. Ian Freshney (2006): Culture of Cells for Tissue Engineering, Wiley - Ulrich Meyer, Thomas Meyer, Jörg Handschel, Hans Peter Wiesmann (2009): Fundamentals of Tissue Engineering and Regenerative Medicine, Springer - Relevant publications will be provided via CIS
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case more than 20% are missed the first try in the exam is lost.
Comments	

Current Problems in Regenerative Medicine

Degree programme	MTE
Semester	3
Course methods	SE
Language	English

ECTS Credits	2.00
Incoming places	Limited
Course description	Analysis of scientific publications, peer-review process, important publications in the subject areaA selection of current issues of regenerative medicine is worked on in small groups with experts, using problem-based learning methodology
Teaching methods	Lecture; problem-based learning part
Learning outcome	After passing this course successfully students are able to ... - to analyze and discuss complex problems of regenerative medicine and their broader context in a structured manner - to identify knowledge gaps and based on these to carry out targeted research, to evaluate possible solutions and to develop their own solutions - to select, prepare and present their own solutions, and to defend them backed up with scientific arguments - to analyse, evaluate and select scientific publications based on common quality standards in the subject area - identify the basic types of scientific publications and differentiate between them, especially original papers, review papers, conference articles, journals and books - evaluate subject specific literature sources (also in English) regarding confirmability, dependability, plausibility, and transferability of insights for comparable problems or contexts and use and reference these in their own work - justify a research question after identifying the current state of the art with regard to scientific considerations, formulate the question comprehensibly and to define verifiable target criteria - relate research results to industry, society, the economy or the environment. - present own or other scientific publications comprehensibly, evaluate them and formulate suggestions for further development.
Course contents	- current problems in regenerative medicine - analysis of scientific publications in the subject area
Prerequisites	semester 1 & 2
Assessment Methods	- immanent assessment method
Recommended Reading and Material	- differs according to area selected
Attendance	Mandatory100% in problem-based learning part

Comments

Stem Cells in Regenerative Medicine

Degree programme	MTE
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	In the first part of the course selected chapters of stem cell biology and the application potential of stem cells (course contains self-study units) are discussed. After accomplishing an exam in the second part of the course students as well as experts in the field of stem cell research present current data.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - name the different types of stem cells including their properties and functions. - explain the factors guiding the different processes in stem cells. - define possible applications of stem cells in the field of tissue engineering. - prepare given papers about stem cells and present them to their colleagues.
Course contents	- different types of stem cells (ESC, adult SC, iPS, fetal SC) - definition and characteristics of stem cells - stem cell niche and its relevance in the development of diseases - fate decision of stem cells - application potential of stem cells - ethics and legal issues of stem cells
Prerequisites	- Molecular Biochemistry and Cell Biology of the first semester- Gene Regulation and Signal of the second semester
Assessment Methods	- intermediate and end exam
Recommended Reading and Material	- Robert Lanza and Anthony Atala (2014): Essentials of Stem Cell Biology, (third edition), Elsevier., ISBN: 978-0-12-409503-8
Attendance	Attendance is mandatory in this course, only 20% of absence is

tolerated. In case more than 20% are missed the first try in the exam is lost.

Comments

Advanced Immunology and Vascular Tissue Engineering

Degree programme	MTE
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	This lecture helps to extend and deepen the knowledge of immunological processes in connection to tissue engineering. Furthermore, basic knowledge in vascular biology will be taught. This is necessary to understand the principles of vascular tissue engineering
Teaching methods	- Lecture- Presentations- Group puzzle
Learning outcome	After passing this course successfully students are able to ... - apply complex immunological processes to tissue engineering - describe the cascades of the wound healing process - describe the processes of formation of blood and lymphatic vessels - recapitulate the principles of vascular tissue engineering
Course contents	- Wound healing - Inflammation - Complement system - Transplantation - Graft rejection - Angiogenesis - Lymphangiogenesis - Endothelial cells in research - Examples of Vascular tissue engineering
Prerequisites	Basic knowledge of immunology
Assessment Methods	- Group puzzle - Collaboration - Paper presentation - Examination (the grades of the exam is the basis, up- or down

	grading is possible by the other assessment criteria)
Recommended Reading and Material	- Current literature (papers) provided during the lecture
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case more than 20% are missed the first try in the exam is lost.
Comments	

Advanced Technologies in Biological Research

Degree programme	MTE
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	Overview of the nanobiotechnological application potential as well as deepening of several sub-topics.
Teaching methods	lectures, presentations, self-dependent working on exercises
Learning outcome	After passing this course successfully students are able to ... - define the concept of thermal energy and relate such concept to understand life-time interactions in biological systems. - describe the principle of electron microscopy (EM) and atomic force microscopy (AFM) for the elucidation of the nanostructure of biomaterials as well as to measure molecular forces between molecules (AFM). - explain molecular modifications for synthetic biointerfaces that control interactions with molecules in biological fluids. - describe and evaluate the colloidal aspects of current nanoscale drug delivery systems. - explain the term biosensor and describe the physical background of optical biosensors (focus on plasmonic properties) including their application in bioassays. - explain different microfabrication methods and microfluidic components, describe the physical principles regarding fluids on a microscale and give application examples for cell analysis based on lab-on-chips.

	- explain the biochemical principles behind binding events relevant for microarrays and give specific examples in which fields microarrays are used. - describe the biochemical principles of molecular nanomotors based on proteins and nucleic acids and give examples of the application potential of such structures. - relate research results to industry, society, the economy or the environment. - present scientific publications comprehensibly, evaluate them and formulate suggestions for further development.
Course contents	- Biosensors - Functional biointerfaces - Biomembranes - Characterization of nanostructures - Drug delivery - Lithography and miniaturization - Microfluidics - Lab-on-a-chip application - Molecular recognition and interaction - Microarrays - Molecular nanomotors
Prerequisites	biochemistry, basics in physics
Assessment Methods	- Collaboration during the lectures - Presentations - Self-dependent solution of exercises - Final exam
Recommended Reading and Material	- Nanobiotechnology II, Wiley-VCH by Mirkin et al. - Biomedical Nanostructures, Wiley by Consalves et al. - Matthew A. Cooper, Label-Free Biosensors, Cambridge University Press, 2009. - F. S. Ligler (editor), Optical Biosensors: Present and Future, Elsevier, 2002 - B. E. A. Saleh, M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, 1991. - scientific literature from the lecture
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% you lose the first try in the exam.
Comments	

Sports Technology (MST)

Sports wear

Degree programme	MST
Semester	3
Course methods	VO
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	Special clothing has developed in leaps and bounds in recent years. Modern, perfectly coordinated equipment has greatly altered the framework of what is humanly possible. In addition to novel materials, it is above all the material mix, the macro-, micro- and also nanostructure, which are responsible for the sometimes extreme properties. This lecture is intended as an introduction to the complex world of modern materials for sportswear.
Teaching methods	Interactive lecture. Cooperation is constantly encouraged! Literature examples from current scientific publications
Learning outcome	After passing this course successfully students are able to ... - Detection of different fiber types - Understanding of complex material architectures
Course contents	- natural fibers - origin, processing, properties - synthetic fibres - complex material compositions - Understand and think further about innovative developments
Prerequisites	none
Assessment Methods	- written examination
Recommended Reading and Material	- slides will be shared
Attendance	
Comments	

Sports practice measurement week - winter

Degree programme	MST

Semester	3
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students work in small groups on a task from the field of Sports Technology. To answer the task, field measurements have to be carried out in winter. Therefore, the students learn what to look out for in field measurements in winter and how to plan and carry them out.
Teaching methods	Group work. Practical testing of the measurement setup in the laboratory. Practical measuring outdoors.
Learning outcome	After passing this course successfully students are able to ... - to estimate and plan the effort and the course of small projects on metrologically supported field studies in winter. - to understand, solve and process measurement tasks for the collection of representative data sets of metrologically supported field studies in winter. - to evaluate, interpret, analogously represent and present the measurement signals obtained during field studies supported by measurement technology in winter.
Course contents	- Planning and execution of a field study in winter. - Selection of suitable sensor technology. - Planning and assembly of the measuring chains. - Testing of the selected methods (sensor technology, measuring chains) in the laboratory. - Application of the appropriate measuring technique in the field. - Discussion of the obtained measurement results considering the influences and problems of a field study in winter.
Prerequisites	All contents of the courses from the 1st and 2nd semester.
Assessment Methods	- Final report (50%) - Final presentation (50%)
Recommended Reading and Material	- Reference books, articles in journals, etc. depending on the task. - Technical books, user manuals, data sheets, etc. depending on the sensor and measurement technology used.
Attendance	Attendance is mandatory during the entire measurement week. There is no obligation to be present during the preparation.

Comments

Design

Degree programme	MST
Semester	3
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course students will get an introduction to Industrial Design/Productdesign and an overview on workflow, tasks and tools a designer uses. A project will be done during the semester by the students in small teams - going through all the steps of the designprocess. With a special focus on using ‚Keyshot' (Rendersoftware) to visualize CAD Files
Teaching methods	Projectwork. Introduction Rendersoftware `Keyshot´
Learning outcome	After passing this course successfully students are able to ... - to understand the workflow, tasks and tools a designer uses - to know the process of a complete designproject - to visualize/render CAD files using ‚Keyshot' as a Rendersoftware
Course contents	- Complete workflow of a designproject done by each student in small teams
Prerequisites	CAD Software
Assessment Methods	- Intermediate and final presentation
Recommended Reading and Material	
Attendance	Mandatory
Comments	

Product management

Degree programme	MST
Semester	3

Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The course will teach basics of product management. You will learn about product stages until the launch and tools of successful brand management.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - Knowledge of positioning and organization of product management - Process of finding new ideas and innovative products - Exercise methods of product management
Course contents	- Basic of product management - Internal and external tasks of product management - Factors of success in product development - Priorities in marketing mix - Approach and best practice of market leaders - Case studies
Prerequisites	
Assessment Methods	- Case study - Final exam
Recommended Reading and Material	- Cooper, 2011, Winning at new products - Kotler, Armstrong, Wong, Saunders, 2011, Grundlagen des Marketings - Meyer (Hrsg.), 2010, Marken-Management - Pulizzi, 2014, Epic content marketing
Attendance	Compulsory attendance
Comments	

Bionics

Degree programme	MST
Semester	3
Course methods	VO
Language	English

ECTS Credits	2.00
Incoming places	Limited
Course description	Recognize natural systems as model for the developement of innovative applications in all areas of modern life. Using knowledge based on fundamental understanding of biological systems can enable materials, systems and applications with innovative properties that outperform traditional solutions significantely.
Teaching methods	interactive lectures. Questions and participation is asked for!
Learning outcome	After passing this course successfully students are able to ... - - use natural sciences to investigate and understand the fundamental mode of operation of biological systems - - discuss the use of bionic for developements in sports technology - - create knowledge on the basis of biological systems and transfer it to the developement of technical applications
Course contents	- - definition and discussion of the term "Bionics" - - fuctions of biological surfaces - - possible applications of bionics in the area of Sports Technology
Prerequisites	no special prerequisites necessary
Assessment Methods	- written examination
Recommended Reading and Material	- slides will be shared
Attendance	
Comments	

Aerodynamics

Degree programme	MST
Semester	3
Course methods	VO
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course aims to develop an understanding of the aerodynamicaland hydrodynamical properties of sports equipment

	and to develop theability to change those by dedicated construction measures. To this end the basics of hydrodynamics are first introduced which are then applied to specific examples occurring in the development of sports equipment.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe the consequences of the shape of sports equipment on its aerodynamical and/or hydrodynamical behaviour. - purposely influence the aerodynamical and/or hydrodynamical behaviour of sports equipment by measures concerning its design. - perform basic hydrodynamical calculations. - describe motions along stream filaments and streamlines. - apply CFD-methods in the modelling of the aerodynamical and/or hydrodynamical behaviour of sports equipment to better understand the latter and to modify it be design changes.
Course contents	- hydrostatics - hydrodynamical basics - motions along stream filaments and streamlines - viscous flows - flows with and without vorticity - compressible flows - inviscid flows - CFD - Computational Fluid Dynamics
Prerequisites	- Foundations of technical, natural, and applied sciences-Mathematical foundations
Assessment Methods	- Final exam (oral presentation of work done in groups) and oral exam
Recommended Reading and Material	- Laurien, E., Oertel, H., 2013, Numerische Strömungsmechanik, Springer Vieweg - Oertel, H., Böhle, M, Reviol, T., 2015, Strömungsmechanik für Ingenieure und Naturwissenschaftler, Springer Vieweg - Hucho, W-H., 2012, Aerodynamik der stumpfen Körper, Springer Vieweg
Attendance	Especially for the PC lab hoursand also for assignment of group workduring term personal presence is necessary.Hence, overall a 75% presence during termis expected.
Comments	

Biomechanical Multibody Simulation

Degree programme	MST
Semester	1
Course methods	UE
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course, students learn to use biomechanical or musculoskeletal simulation software to analyse and predict muscle and joint forces that occur in human movement and sport. They will gain basic knowledge of AnyBody and OpenSim software.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Materials Science in Sports Technology

Degree programme	MST
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The Course Materials Science in Sports Technology teaches the basics of materials (metals and polymers); these include their structure and their properties, as well as their testing (part 1: Basics). Building on the basics, the understanding of materials is extended and deepened (part 2: Consolidation).In detail, the two parts

	includePart 1 Basics Materials Structures Materials Testing Metals & Alloys (Steel; Al, Mg, Ti & Alloys) PolymersThe exam for part 1 ('intermediate exam') must be taken by all students, also by those which have successfully passed the exams of the respective BHF/BST courses of TECHNIKUM WIEN. Please note that the slides have been updated with respect to any of the previous BHF/BST or MST courses.Part 2 Consolidation Nanocrystalline Metals & Alloys Amorphous Materials Materials Failure Creep & Chemical Degradation of Polymers Additive Manufacturing & 3D Printing
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Mechanical Calculations in Sports Technology

Degree programme	MST
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	After discussing the theoretical fundamentals of physics and mechanics, examples from the broad field of sport are discussed, analysed and calculated based on the principles of technical mechanics. Examples from the fields of sports technology / sports engineering are used to convey the content.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Applied Biomechanics

Degree programme	MST
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In addition to the basics of biomechanics and some examples from sports biomechanics, this course also covers the basics of simulating human movements and the resulting calculation of muscle and joint forces. The topics mainly include the biomechanics of cycling and running, as well as technical and biomechanical backgrounds in Paralympic sports.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Information Systems Management (MWI)

Systems Engineering

Degree programme	MWI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

This course provides an introduction to the Systems Engineering (SE) as an interdisciplinary engineering approach that provides solution for complex engineering problems. SE looks at a system as a whole while understanding its internal structure, internal and external interfaces and their interactions with their environment in diverse context. SE forces the Systems Engineers to communicate the issues of the stakeholders, guides them during system requirements analysis life-cycle and supports their decision making procedures at different solution levels until life-cycle activities culminate in a system architecture design covering all functional and non-functional stakeholder requirements. The diversity of the parts of a complex system cannot be engineered independently of one another, therefore, SE bridges the traditional engineering disciplines and coordinates activities while individual parts of a complex system are designed, implemented, tested, and integrated by different organizations.

Teaching methods

ILVStudent-centered teaching utilizing team project to help students to understand the "Systems Engineering" discipline better.

Learning outcome

After passing this course successfully students are able to ...
- describe processes, methods, and practices of systems engineering
- use the systems engineering vocabulary/terminology
- recognize systems engineering as a part of project management
- apply requirements analysis techniques for a particular system
- understand the importance of a high quality specification and can create specification
- understand the risk management and cost estimation in systems engineering

Course contents

- Introduction to Systems Engineering
- Systems Engineering Viewpoint
- Complex Systems
- Systems Development Process

	- Concept Development Stage - Systems Engineering Management - Decision Analysis and Tools - Systems Modelling with UML
Prerequisites	Software Engineering
Assessment Methods	- Quiz - Team Project - Final Presentation
Recommended Reading and Material	- Syllabus based on "Systems Engineering Principles and Practice, 2nd Edition, Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour, Steven M. Biemer"
Attendance	Attendance is mandatory!
Comments	For detail information see Moodle

IT-Governance (ITIL, Cobit)

Degree programme	MWI
Semester	3
Course methods	ILV, FL
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Understanding IT organizations as customer-driven service organizations, this course puts the focus on all aspects necessary to provide efficient and effective IT services. And while technical assets are still central to IT service organizations, the focus shifts to non-tangible assets like knowledge, capabilities and processes. The course explains best practices and international standards in IT management/governance like Cobit and ITIL.
Teaching methods	Lecturer presentationsStudent recapsIn-course exercises & case studiesGroup work
Learning outcome	After passing this course successfully students are able to ... - give an overview of the relevant standards and frameworks as well as discuss them regarding their use for an organization - name and apply the parts of ITIL4 - give an overview of COBIT2019 and its key principles

	- give an overview of the aspects of COBIT implementation and COBIT assessment
Course contents	- IT process management - IT service management - IT governance - Cobit - ITIL
Prerequisites	Foundations of IT managementFoundations of process management
Assessment Methods	- Assessment of group work and final exam - Assessment of in-course contribution
Recommended Reading and Material	- see moodle course
Attendance	attendance required
Comments	

Knowledge and Document Management (Spezialisierung)

Degree programme	MWI
Semester	3
Course methods	ILV, FL
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course starts with a short overview about different knowledge management approaches (as for example the one according to Probst et. al), as well as about the applicable software systems in the different phases/ processes/ blocks of the knowledge management.Afterwards the students learn the different possibilities for the knowledge sharing in companies, while applying different eLearning systems. Furthermore the targeted application of software systems for the implementation of the document management in companies will be learned by the students.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe different knowledge management approaches - apply selected eLearning systems for the implementation of

	eLearning scenarios for the dissemination of knowledge - apply different software systems for the implementation of the document management in companies
Course contents	- Overview about knowledge management approaches - Overview about software systems for the knowledge and document management - eLearning systems for the dissemination of knowledge in companies - Software systems for the implementation of document management in companies
Prerequisites	None
Assessment Methods	- Course immanent assessment method - End exam
Recommended Reading and Material	- see Moodle
Attendance	
Comments	

Renewable Energies (MEE)

Control Technology

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Development of control technologies for the automation of buildings, industrial processes and electrical grids. Special attention is paid to the requirements regarding energy saving, the use of renewable energies, the digitalization of electrical grids and the consideration of cyber security.
Teaching methods	Lecture, discussion, seminar work and practical exercises
Learning outcome	After passing this course successfully students are able to ...

- analyse requirements for a control system
- develop a control system from actor-sensor basis up to the process control system
- evaluate the most important industrial bus-systems according to the required control features as well as their possible application
- classify and apply the current standards for building automation, industrial automation and smart grids.
- recognize the danger based on malware and to propose countermeasures

Course contents

- Basics of the data transfer including error detection and interfaces between different bus-systems and the importance of the ISO/OSI-model
- Requirements concerning the structure of a control-system including the building automation & the piping and instrumentation diagramms
- Requirements concerning the Industrial Ethernet and the use of standardized protocols
- Structure of a process-close control station including sensors and actors for binary and analogue data
- Getting to know the standardized programming languages according to IEC 61131-3
- Advantages and disadvantages of different bus-structures as star, ring and line topology
- Advantages and disadvantages of different bus medias as cable, optical fiber and wireless based on European standards
- Estimation of the probability of failure for different structures of the supervisory control and data acquisition system
- Origins of electromagnetic interferences and possible corrective actions and how to avoid electromagnetic interference during industrial data transmission
- Method of operation and application of smart meter in smart grids

Prerequisites

Following basic knowledge is necessary:= Principles of electrical engineering and of electrical networks = Electromagnetic Compatibility (EMC)= Measuring electrical und non-electrical process data= Information and microprocessor technology, programming language= Data network and data transfer including Ethernet and ISO/OSI-model

Assessment Methods

- Written exam
- Seminar work
- Exercises

Recommended Reading and Material	- T. Hansemann und C. Hübner, "Gebäudeautomation - Kommunikationssysteme mit EIB/KNX, LON und BACnet" - G. H. Schildt und W. Kastner, "Prozessautomatisierung" - M. Weyrich, "Industrielle Automatisierungs- und Informationstechnik" - W. Babel, "Systemintegration in Industrie 4.0 und IoT: Vom Ethernet bis hin zum Internet und OPC UA" - G. Schnell, "Bussysteme in der Automatisierungs- und Prozesstechnik" - W. Schneider, B. Heinrich, "Praktische Regelungstechnik"
Attendance	75% Attendance is compulsory
Comments	

Investment and Financing

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this sub-module, students acquire basic knowledge and skills in the field of finance.
Teaching methods	Flipped Classroom
Learning outcome	After passing this course successfully students are able to ... - At the end of the course the students are able to define the terms "investment" and "financing", to outline a typical investment process, to check investment projects by means of static or dynamic methods for their advantageousness, to determine the optimal useful life of an investment, to model investment program decisions in the form of linear systems of equations, to consider the uncertainty of future cash flows in capital budgeting, distinguish between equity and debt capital as well as between internal and external financing, provide a structured overview of short, medium and long-term debt financing instruments, prepare a financial plan for short-term liquidity management, outline the mode of operation and limitations of the leverage effect, model investment and financing calculations in

	Microsoft Excel.
Course contents	- Investment concept - Investment process - Key figures for asset analysis - Static investment calculation methods - Dynamic investment calculation methods - Investment calculation with Excel - Optimal service life - Taxes in the investment calculation - Utility analysis - Investment calculation with uncertainty and risk - Investment Program Planning - Financing term - Equity vs. debt capital - Internal financing - Working capital management - External financing - Ordinary capital increase and subscription right - Stock exchange - Leverage effect
Prerequisites	Fundamentals of business administration (1st semester)
Assessment Methods	- final exam: 100%
Recommended Reading and Material	- Wala, Haslehner, Kreidl: Investitionsrechnung und betriebliche Finanzierung, LexisNexis - Wala, Baumüller: Klausurtraining Investitionsrechnung, BookBoon
Attendance	See examinations regulations
Comments	Details see moodle course

Energy Storage Technologies

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Basics of energy storages: The lectures have the goal to give the

	students a basic understanding about the energy storage systems. The lectures describe the main laws of the energy storage systems and their use for designing simple application.
Teaching methods	Integrated lectures
Learning outcome	After passing this course successfully students are able to ... - explain the design and operation of different energy storages - choose energy storages for specific applications
Course contents	- Structure and functionality of the different storage systems (Electrical, thermal, P2X, component activation, etc.) - Identify the requirements for each application - Safety - Storage selection and sizing - Storage monitoring and balancing - Test procedure - Modeling and parameter identification
Prerequisites	Construction engineering, electrical and thermal energy engineering at bachelor level
Assessment Methods	- Exam
Recommended Reading and Material	- Jossen A. und Weydanz W.: Moderne Akkumulatoren richtig einsetzen, Inge Richardt Verlag, 2019 - Sterner M. und Stadler I.: Energiespeicher – Bedarf, Technologien, Integration, Springer Vieweg, 2014 - Kurzweil P. und Dietlmeier O. K.: Elektrochemische Speicher, Springer Vieweg, 2015 - Bauer S.: AkkuWelt, Vogel Business Media, 2017
Attendance	
Comments	

Introduction to Modelling and Simulation

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	Modeling, simulation and optimization of specific energy systems: On the basis of project work, technical energy systems such as a PV or wind power system, a building energy system, a district anergy network or an energy community are modeled, simulated and optimized. The focus is on the application of the theoretical principles and methods imparted in MEE1-4 to examples from everyday energy technology. Students can choose from one of four energy technology projects: BIPV, Buildings, Plus Energy Quarter and Energy Community, program a model of the system in appropriate languages and tools such as Matlab, Python, TRNSYS, PowerFactory and use it to carry out simulations and optimizations. The focus is on the application of simulation technology and programming. The content-related consideration and analysis of the exemplary systems will be deepened in the further course of the curriculum.
Teaching methods	Project work with Q&A and presentation of the project progress in face-to-face and distance learning for the independent creation of the models, implementation of the simulation and documentation in the form of a project report
Learning outcome	After passing this course successfully students are able to ... - To model and simulate more complex energy systems - To produce, test and use the necessary code - Perform optimizations for an energy system - Combine several individual models to form a larger overall model - To assess and name the applicability, strengths and challenges of typical energy system models - Explain the code involved and find and fix bugs in it
Course contents	- Students choose a project of a typical energy system: - - Building energy systems (PV simulation, Building thermal model) - - Positive energy Districts (Integrated models, District energy networks) - - Energy community systems (PV, Emobility, Storage) - - Building Integrated PV systems (Electrotechnical Systems)
Prerequisites	MEE1-4 Introduction to Modelling and Simulation
Assessment Methods	- 30% intermediate presentation of the exercises (teamwork) halfway through the course - 70% final presentation of the exercise results at the end of the course (open book) with an integrated examination discussion on understanding and theory. The students present their executable model and answer questions about its function and structure. The

	focus of the performance assesment is on the handling of the model. Students should be able to explain how the modeling and simulation can be implemented
Recommended Reading and Material	- Nollau, R., 2009. Modellierung und Simulation technischer Systeme: Eine praxisnahe Einführung. Springer-Verlag, Berlin Heidelberg. https://doi.org/10.1007/978-3-540-89121-5 - Crastan, V., 2004. Modellierung und Simulation, in: Crastan, V. (Ed.), Elektrische Energieversorgung 2: Energie- und Elektrizitätswirtschaft, Kraftwerktechnik, alternative Stromerzeugung, Dynamik, Regelung und Stabilität, Betriebsplanung und -führung. Springer, Berlin, Heidelberg, pp. 367–412. https://doi.org/10.1007/978-3-662-06958-5_10
Attendance	Mix of classroom and distance learning (50-50)
Comments	

Specialization Focus Definition and Scientific Methods

Degree programme	MEE
Semester	1
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course provides an introduction to the principles of scientific work, focusing on the structural design and implementation of scientific projects.Students engage in the analysis of interdisciplinary research projects to examine their structures, holistic approaches, and the interconnections between various disciplines. Particular emphasis is placed on the autonomy to define individual priorities, enabling students to decide which aspects or disciplinary perspectives to emphasize in their analysis. The objective is to foster interconnected thinking and critically evaluate the complexity and value of interdisciplinary approaches.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - understand and be able to reproduce the structure, implementation and choice of methods of scientific work/publications

	- understand holistic, interdisciplinary evaluation systems and be able to think in a networked way and reproduce them conceptually - understand the results, be able to classify them and interpret them in a wider context - write up the results of the project work, taking into account the formal (e.g. linguistic implementation,...) and content-related requirements (e.g. quality of their own contribution,...) - apply methods from different disciplines to create holistic concepts
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Ethics in Technology

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Ecological and societal aspects of (energy) technology application is covered and deepened through two coursesEthics in technology
Teaching methods	Blended learning – short interactive theoretical inputs, deepening exercises in small groups, discussions, presentations
Learning outcome	After passing this course successfully students are able to ... - to link the acquired knowledge on ethical basics of technology development and application with the area of renewable energy
Course contents	- Basics, dimensions of responsibility etc, different ethical concepts, application of these notions within the context of sociotechnical systems
Prerequisites	none

Assessment Methods	- E-learning tasks. presentations, test
Recommended Reading and Material	
Attendance	75 %
Comments	

Ecology and Society

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Ecological and societal aspects of (energy) technology application is covered and deepened through two courses Ecology and society
Teaching methods	Blended learning – interactive presentations, discussions, deepening in moderated self-study phases in small groups
Learning outcome	After passing this course successfully students are able to ... - to explain basically functions of ecosystems - to identify, explain and assess anthropological impacts on the environment - to explain important interdependencies between environment and society - to assess the impact of technology application on humans and environment
Course contents	- Basic information on ecosystems, interdependencies, Human ecology: ecological and societal impacts of technology application, measures, actions etc., basic information on social interconnections, political frameworks, interdependencies between environment and society, energy and environmental protection, energy and sustainable development
Prerequisites	none
Assessment Methods	- E-learning Tasks, written test, oral exam
Recommended Reading and Material	

Attendance	50 %
Comments	

Innovation and Technology Management

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course, students acquire basic knowledge and skills in the field of innovation and technology management.
Teaching methods	Self-study, lecture, discussion, group work, case studies, multimedia presentations, reflection, critical thinking, flipped classroom
Learning outcome	After passing this course successfully students are able to ... - understand the basics of innovation management and the tasks of innovation managers - understand the importance of innovation for corporate success - create the organizational and personnel requirements for an innovation-friendly corporate culture - know a systematic innovation process from idea generation to market launch - know the advantages of different (open) innovation methods - gain an overview of current developments and place them in context - understand the basics of technology management
Course contents	- Theory on innovation - Innovation culture and change management - Innovation management methods - Idea management - Innovation strategy & process - Technology management in the context of research and innovation - Current real world examples
Prerequisites	none
Assessment Methods	- written reflection

Recommended Reading and Material	- as in Moodle
Attendance	
Comments	Detailed information and additional teaching materials are made available via the Moodle learning platform

Medical Engineering & eHealth (MME)

Economics and Marketing

Degree programme	MME
Semester	3
Course methods	SE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The objective of this class is to provide an understanding how healthcare markets work and how market participants behave there. Students will learn how companies can use marketing tools to successfully conduct analyses, develop strategies and place products in the healthcare market.
Teaching methods	Lectures with Powerpoint charts, discussions and case studies of marketing- and businessplanning. In addition students will prepare a marketing plan for a new product.
Learning outcome	After passing this course successfully students are able to ... - explain the economic behavior of supply and demand on markets - describe and evaluate the various types of markets - explain and evaluate various marketing strategies, particularly in connection with the product life cycle - evaluate the instruments of the “Marketing Mix” to achieve specific marketing goals - develop an understanding of the medical market processes - prepare a marketing plan for a health care product
Course contents	- Healthcare markets, essential elements of microeconomic theory (Demand and supply, market types based on competition etc.), basics of healthcare marketing (Mix of marketing tools, strategies, marketing plan, sales call)

Prerequisites	
Assessment Methods	- Marketing Plan, oral exam
Recommended Reading and Material	- Walter J. Wessels – Economics, Barrons 2012, 5th Edition, ISBN 13: 978-0764147609Recommended for Marketing: - Philip Kotler, Kevin Lane Keller, Friedhelm Bliemel - Marketing Management - Fred Harms, Dorothee Gänshirt - Gesundheitsmarketing - Nils Bickhoff, Svend Hollensen, Marc Opresnik - The Quintessence of Marketing
Attendance	Minimum 80%, otherwise first attempt to take the exam is counted as a failure
Comments	This class will partly be conducted for both students of MTE and MBE in the 3rd semester.

Selected Problems in Medical Engineering & eHealth

Degree programme	MME
Semester	3
Course methods	VO
Language	English
ECTS Credits	1.00
Incoming places	Limited
Course description	This course gives an overview and offers experience reports from thematic fields in which alumni of this study program might work
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - discuss current topics from the field of medical engineering and eHealth - discuss interfaces of medical engineering and eHealth to related fields of competence
Course contents	- Overview on tasks and activities within the topics of the study program and beyond
Prerequisites	
Assessment Methods	- Course immanent assessment method
Recommended Reading	- Slide sets of the lecturers

and Material	
Attendance	Attendance is compulsory
Comments	

Respiration Technologies

Degree programme	MME
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	This course introduces different aspects of ventilation, lung simulation and the measurement of aerosols in respiratory processes and demonstrates the practical application in laboratory exercises
Teaching methods	Seminars, Group Work, Laboratory Experiments
Learning outcome	After passing this course successfully students are able to ... - Apply the basics of ventilation techniques - Identify and explain potential methods of lung simulation - Explain aerosol production and measurement techniques and apply them practically
Course contents	- Pulmonary system testing - Techniques for ventilation - Methods for simulation of human lung - Techniques for aerosol production - Techniques for aerosol measurement
Prerequisites	Lung Anatomy and Physiology, Basics in fluid dynamics
Assessment Methods	- Laboratory Protocols - Assignments - Final Exam
Recommended Reading and Material	- Teaching material in the moodle course
Attendance	Attendance in lectures is optionalAttendance in laboratories is mandatory
Comments	

Biosignal Processing

Degree programme	MME
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	This course provides a theoretical and practical introduction into the technologies used to record and analyze data from biosignals.
Teaching methods	Lectures about theory and background, practical student work using Python.
Learning outcome	After passing this course successfully students are able to ... - develop an algorithm in Python to recognize patterns in annotated biosignal data and to measure its performance by applying state-of-the-art signal processing and pattern recognition technologies (machine learning). - describe the most important concepts related to polysomnographic sleep scoring (e.g. sleep stages, transient patterns, scoring standards).
Course contents	- Basics about biosignal recording: sensor positions, recording settings, referencing - Basics about biosignal processing: spectral analysis, frequency bands, filtering, event-related potentials (ERP) analysis - Introduction to polysomnography: sleep stages, transient patterns like spindles, scoring standards - Practical student work using Python: European Data Format (EDF), signal processing with numpy and scipy - Artifacts and their treatment: types of artifacts, artifact minimization and rejection - Sleep analysis: Somnolyzer 24x7 as a reliable sleep stager, quality reviewing of automatic analysis - Spatial EEG analysis: topography, source localization methods: low-resolution brain electromagnetic tomography (LORETA) - Applications: EEG, ERP and sleep studies in clinical practice and scientific research
Prerequisites	Basic statistics. Python knowledge is helpful but not mandatory.

Assessment Methods	- Project in small groups
Recommended Reading and Material	- Kemp, Bob, et al. "A simple format for exchange of digitized polygraphic recordings." Electroencephalography and clinical Neurophysiology 82.5 (1992): 391-393. - Kemp, Bob, and Jesus Olivan. "European data format 'plus'(EDF+), an EDF alike standard format for the exchange of physiological data." Clinical Neurophysiology 114.9 (2003): 1755-1761. - Anderer, Peter, et al. "Artifact processing in computerized analysis of sleep EEG – a review." Neuropsychobiology 40 (1999): 150-157. - Anderer, Peter, et al. "Advanced analysis of pharmaco-sleep data in humans." Neuropsychobiology 72 (2015): 178-187. - Bakker, Jessie et al. "Scoring sleep with artificial intelligence enables quantification of sleep stage ambiguity: Hypnodensity based on multiple expert scorers and auto-scoring" Sleep (2022) Jul 3:zsac154. doi: 10.1093/sleep/zsac154.
Attendance	Attendance is required at the practical exercises and at the project deadline meeting, otherwise voluntary (but advisable)
Comments	

Image Analysis

Degree programme	MME
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	Methods for Image processing for medical image technologies, e.g. CT, PET
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - list and explain the usage of file formats - perform simple operations of image processing in intensity, image and spatial space - visualize and render image data for display - describe the basics of the fusion of multimodal image data
Course contents	- Image representation, file formats, and simple operations

	- Operations in intensity space - Filters and image transforms - Spatial Transformations - Registration - Visualization and Rendering
Prerequisites	
Assessment Methods	- Course immanent assessment method and end exam
Recommended Reading and Material	- See course material in the campus system
Attendance	Attendance not required
Comments	

Advanced Analysis of Medical Data

Degree programme	MME
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	Theory of Multivariate Statistics
Teaching methods	Interactive Lecture with lots of MatLab examples and assignments
Learning outcome	After passing this course successfully students are able to ... - do Multiple Regression Analysis - name MVA Techniques - test and prepare statistical data - do a Factor Analysis - do an independent component analysis - find classificators and do general pattern recognition - analyse time and synchronisation problems using using statistical methods - apply support vector machines SVM to problems - analyse nonstationary problems using statistical methods
Course contents	- Multiple Regression Analysis - Classification of MVA Techniques - Basis of MVA – testing and preparing data

	- Factor Analysis - ICA – independent component analysis - Classification / Pattern Recognition - Time and synchronisation Problems - SVM - Nonstationary Problems
Prerequisites	Statistics and linear algebra, MatLab
Assessment Methods	- Assignments
Recommended Reading and Material	- Multivariate Data Analysis by Joseph F. Hair - Computer-Aided Multivariate Analysis by Abdelmonem Afifi - Pattern Classification by Richard O. Duda - Independent Component Analysis by Aapo Hyvarinen
Attendance	not mandatory
Comments	

Clinical Engineering

Degree programme	MME
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited
Course description	This lecture gives an overview on the wide field of medical equipment installed and used in hospitals, the special focus is laid upon - how is the equipment used- what is required for its proper installation and application.
Teaching methods	Presentations, Excursions - if possible due to Covid, Presentations from the Students.
Learning outcome	After passing this course successfully students are able to ... - explain the function and application of the most important medical equipment - explain the key parameters for a technical evaluation of the most important medical equipment - explain the pre-installation - requirements of the most important medical equipment for a functional and proper installation of the

	equipment - explain the processes of hospital planning using examples
Course contents	- Project Phases in a Hospital Project - Basics of functional Hospital Planning (Zoning, Layout) - special requirements for electrical installations in a hospital (UPS, line impedance, ...) - Medical Equipment from A to Z
Prerequisites	Basics of Anatomy, Physiology, Physics, Electrical engineering and Mechanics
Assessment Methods	- Multiple choice exam (Computer) at the end of the semester
Recommended Reading and Material	- See material in the campus system CIS, Moodle
Attendance	Attendance in the lectures is voluntary and recommended.
Comments	

Modelling in Cardiovascular Systems

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course provides basic knowledge of cardiovascular system dynamics, in particular focusing on the numerical and computational fluid dynamic modeling of cardiac (patho)physiology and mechanical circulatory assistance.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	

Attendance	
Comments	

Workflows and Communication

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The course provides an overview of workflows in healthcare systems, focusing on distributed and shared workflows within healthcare providers. Typical workflow examples are introduced, along with communication skills relevant to healthcare settings. The content aligns with the PRT course and incorporates perspectives from partner universities and institutions.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Digital Leadership

Degree programme	MME
Semester	1
Course methods	UE
Language	English
ECTS Credits	2.00

Incoming places	Limited
Course description	The course focuses on the role of leadership throughout different stages of team development, using models like Tuckman's stages of group development to derive relevant leadership actions (e.g., directive leadership in the forming phase). It explores tools for diagnosing team dynamics, such as Rank Dynamics, Drama Triangle, and TZI, and develops strategies for addressing these dynamics through case-related activities like delegation of responsibility and fostering critical discussions. Additionally, the course incorporates agile approaches to enhance team collaboration and adaptability.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Medical Information Systems

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course focuses on IHE Technical Frameworks, as utilized in electronic health records like the Austrian ELGA, also considering other standards e.g. for sharing data from medical devices. It enables to develop standardized, interoperable, and future-proof medical information systems.

Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Microprocessor Applications in Medicine

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This course focuses on pratical application of microcontroller basics and programming techniques in a biomedical engineering context. The utilisation of microcontroller peripheral units via the C/C++ programming language will be shown, and in a step-by-step process a firmware for measuring bioelectric signals and for sending this data to a PC will be programmed in small groups.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Company Simulation

Degree programme	MME
Semester	1
Course methods	SE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course explores key aspects of financial analysis and decision-making in a corporate context, including the interpretation of financial reports, evaluation of financial ratios, cost of capital, capital structure, company valuation, and the use of risk management tools. Practical applications provide insights into strategic financial planning and corporate performance assessment.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Project-Related Teamwork 1

Degree programme	MME
Semester	1
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course focuses on the design, management, and execution of a

	comprehensive team project within the field of biomedical engineering. Students will gain practical experience by developing detailed project plans, producing documentation and prototypes, writing a scientific paper, and presenting their findings. PRT interacts with other courses that provide students with methods, tools, and practical approaches to address the systemic health challenges related to each project. Through a hands-on, interdisciplinary approach, students will strengthen their teamwork and problem-solving skills in biomedical engineering.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Cellular Electrophysiology and Bioimpedance

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course examines the electrical behavior of cells and tissues in response to electromagnetic fields. It covers the principles, techniques, and potential medical uses of electrophysiology and bioimpedance measurement in diagnostics and therapy.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	

Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Robotics Engineering (MRE)

Advanced Programming

Degree programme	MRE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	A modern approach to object oriented programming.
Teaching methods	lectures and webinars - with additional Moodle exercises / examples.
Learning outcome	After passing this course successfully students are able to ... - program console applications in C++ - perform basic object-oriented programming - apply object-oriented concepts
Course contents	- classes and objects - inheritance / polymorphism - templates, interfaces, STL - RAII
Prerequisites	**basic knowledge of a structured programming in C (C++)**
Assessment Methods	- continuous assesment in course
Recommended Reading and Material	- C++: das umfassende Handbuch, Will Torsten T., ISBN-9783836275958 - Schaum's Outline of Programming with C++John Hubbard ISBN-10: 3826609107ISBN-13: 978-3826609107
Attendance	attendance not required but recommended!
Comments	

Advanced Programming for Robots

Degree programme	MRE
Semester	1
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this lecture, you will learn, how to communicate with a robot by the help of TCP/IP, to be able to control it, send data and receive data.
Teaching methods	Lecture, moodle exercises, hands-on exercises
Learning outcome	After passing this course successfully students are able to ... - After the LV you will be able to communicate with a robot via network. - After the LV you will be able to launch parallel processes and controll them - After the LV you will be able to launch threads and controll them
Course contents	- Process handling - Thread processing - TCP/IP communikation
Prerequisites	**basic knowledge of a structured programming in C (C++)**
Assessment Methods	- Projekt
Recommended Reading and Material	
Attendance	100%
Comments	

Digital Leadership

Degree programme	MRE
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course will provide an overview of the latest practical and theoretical leadership concepts. Students will gain practical insights into the challenges of leadership and transformation, for example, in international organizations, and they will also develop new perspectives on the contemporary world of work and the theme of leadership. One of the course's fundamental components will be a student created reflection on specific issues concerning leadership and their implementation.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - identify and explain the tasks and instruments of leadership (for example, delegation, agreement on objectives) as well as to explain classical management models (for example, the leading continuum, the maturity model), to weigh the advantages and disadvantages of different leadership theories and concepts and to apply these to practical examples - describe agile leadership (e.g. in expert organisations, transformation processes) and use it as an example of leadership - explain the exact, academic, understanding of digital leadership (e.g. coaching culture) and apply this concept to specific cases - apply the systemic loop (from the perspective of a leadership position) in a theoretical manner to interdisciplinary or intercultural teams - understand the essential techniques of leadership in an intercultural context - outline the most important trends in the labour market - motivate employees and lead virtual teams in an increasingly digitalized world of work
Course contents	- Fundamentals of leadership, traditional traits, behavioural and situational theories of leadership - Systems theory in social systems - Leadership in a digital context - Modern leadership concepts (agile leadership, transformational leadership, servant leadership and other such theories) - Interdisciplinarity and interculturality - Trends in the economy: the labour market, globalisation, digital transformation and Industry 4.0 - The specifics of leading teams of experts
Prerequisites	none

Assessment Methods	- Participation in workshops, exercises, case studies, written exam
Recommended Reading and Material	- Berninger-Schäfer, E. (2019): Digital Leadership; Die Digitalisierung der Führung, managerSeminare Verlags GmbH - Franken, S. (2019): Verhaltensorientierte Führung; Handeln, Lernen und Ethik im Unternehmen, 4. Auflage, Gabler - Gasteiger, R., Kaschube, J., Rathjen, Ph. (2016): Interkulturelle Führung in Organisationen, Menschen in globalen Kontexten effektiv führen, essentials Springer Gabal - Greßer, K., Freisler, R. (2020): Ready for Transformation; Neue Arbeitswelt, digital und agil…, managerSeminare Verlags GmbH - Wunderer, R. (2011): Führung und Zusammenarbeit, Eine unternehmerische Führungslehre, 9. Auflage, Luchterhand - Lerch, Sebastian (2017): Interdisziplinäre Kompetenzen, UTB - Lüthi, E., Oberpriller, H., Loose, A., Orths, St. (2013): Teamentwicklung mit Diversity Management, Haupt - Wunderer, R. (2011): Führung und Zusammenarbeit, Eine unternehmerische Führungslehre, 9. Auflage, Luchterhand
Attendance	Attendance is compulsory
Comments	none

Industrial Engineering & Business (MIB)

International Finance

Degree programme	MIB
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	Students will get a broad overview of international finance
Teaching methods	Lecture, case studies, exercises
Learning outcome	After passing this course successfully students are able to ... - analyse financial reports of companies according to managerial standards. - apply common financial ratios and interpret their results.

	- identify financial risks and know how to apply hedging instruments to manage these risks.
Course contents	- Analysis of financial statements and specific topics - Financial ratios - Risk management
Prerequisites	None required
Assessment Methods	- Company analysis (Group assignment) 30% - Written exam 70% - Students have to achieve at least a passing level on the written exam and the company analysis respectively to finish the course with an overall positive grade - Written retake exam 70% - Company analysis (individual assignment) 30%
Recommended Reading and Material	- Dr. Karl Knezourek, Slides for the lecture, 2022 - Jeff Madura, Roland Fox, International Financial Management, Thomson, 2019 - Graham Friend, Stefan Zehle, Guide to Business Planning, The Economist Newspaper Ltd., latest edition (Ch.l 14)
Attendance	Attendance of the course is mandatory. Students are allowed to miss a maximum of 20% of classes, otherwise they will loose their first exam attempt.Classes start on time. Students are reminded to arrive on time. Students who arrive late for a lecture will receive 0% attendance for that class.
Comments	

International Law

Degree programme	MIB
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	This course explains the major European institutions, their structure, tasks and influence and focuses relevant topics of International Economic Law.

Teaching methods	Lector and student presentation, group work, case studies
Learning outcome	After passing this course successfully students are able to ... - •list the main bodies of the European Union and list their competencies and impacts on international business - •list relevant topics of international business law and explain the impact on international business - •explain main differences between international tax, competition and business law compared to national Austrian regulations
Course contents	- •Major European regulations - •International tax and anti-trust law - •UN Regulations and INCOTERMS - •Company and Corporation Law - •Intellectual Property
Prerequisites	none
Assessment Methods	- Participation in class - Student presentation - Management Paper - Exam
Recommended Reading and Material	- Publicly available sources - My presentations
Attendance	online
Comments	

Master Thesis und wissenschaftliches Arbeiten

Degree programme	MIB
Semester	3
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Basics of scientific work and writing academic texts
Teaching methods	Lecture, group work, independent work
Learning outcome	After passing this course successfully students are able to ... - independent writing of scientific texts, creation of scientific tables, graphics and directories, literature work and citing

Course contents	- Basics of scientific work and writing academic texts, creation of scientific tables, graphics and directories, literature work and citing
Prerequisites	Elementary knowledge of scientific work from the bachelor's degree
Assessment Methods	- paper and review
Recommended Reading and Material	- course materials - moodle
Attendance	mandatory
Comments	x-x-x

Auslandsaufenthalt 2

Degree programme	MIB
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Professional Writing Skills

Degree programme	MIB
Semester	3
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	In this course you will enhance your ability to write effective texts in English for professional purposes, taking into consideration specific genres, purposes and audiences. In an era of GPT writing tools, this course focuses on the 'human' side of writing, including engaging in collaborative writing tasks, better reflecting the demands of the workplace.
Teaching methods	This course takes a flipped-classroom approach whereby students engage with self-learning materials outside of class in preparation for graded writing assignments in class. All writing assignments then

	receive detailed feedback from expert lecturers.
Learning outcome	After passing this course successfully students are able to ... - Analyze and interpret the linguistic design of texts for different target groups and for various purposes in a business context. - Improvement of competencies for formal English texts in a business context. - Write a variety of text forms without technical support (emails, internal offer memos, literature analyses for process improvement). - Apply writing skills in collaborative writing contexts.
Course contents	- Text analysis - Formal writing - Emails and memos - Text synthesis and recommendation reports
Prerequisites	B2-C1 level English
Assessment Methods	- Continuous assessment of writing skills (in class) (50%) - Written exam (50%)
Recommended Reading and Material	
Attendance	Compulsory as per study programme regulations
Comments	

Public Affairs & Lobbying

Degree programme	MIB
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Corporate public affairs are the "foreign policy" of a company or organisation. Lobbying is the instrument to influence political, legal and socio-political decisions as well as technical regulations in a targeted and strategically planned way. These competences have gained a lot of importance in companies in Austria and the EU. This course provides an insight into what lies behind lobbying and public affairs and how the interaction between business, politics, and

	society works in practice. It introduces how specific corporate goals can be supported through lobbying and public affairs and how quality and compliance can be ensured.
Teaching methods	The teaching content and correlations are conveyed according to the state of scientific knowledge and deepened by numerous practical examples. Complex contexts are additionally made comprehensible through video material. The students apply the knowledge acquired in the final thesis and supplement it with their research.
Learning outcome	After passing this course successfully students are able to ... - After successful completion of the course, students can analyse the socio-political environment of a company and improve the competitiveness of the company through concrete, professional measures.
Course contents	
Prerequisites	none
Assessment Methods	- Development of a written public affairs and lobbying concept based on a self-selected example.
Recommended Reading and Material	
Attendance	80%
Comments	

Introduction to Quantum Information

Degree programme	MIB
Semester	3
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Quantum technologies currently take the decisive leap from foundational research to market readiness. They are one of the key technologies of the 21st century. We study the foundational principles of quantum computing, quantum cryptography and quantum sensing. We put a focus on the state-of-the-art of these technologies as well as chances and risks of their implementation in

	enterpresis and practical aspects such as the certification of quantum technologies.
Teaching methods	• learning together: input by the lecturer mixes with contributions by the studends. we aim at a flipped classroom• learning yourself: material for literature research and a moodle-course guide the self-study phases• learning hands-on: this course is complemented by a Lab class in which the students apply the knowledge gained
Learning outcome	After passing this course successfully students are able to ... - give an overview over the state-of-the art of quantum technologies - explain quantum computing, quantum cryptography and quantum sensing as well as their differences - differentiate between enabling technologies and applications of quantum technologies - explain fundamental mathematical concepts of quantum information and apply them to simple cases - explain fundamental concepts of quantum information: superposition, entanglement, measurement, no cloning, teleportation - describe protocols of quantum key distribution - discuss practical aspects of quantum key distribution - describe physical platforms for quantum computing - apply measures for quantum computers (T1, T2, quantum volume) - understand quantum gates and apply them in simple algorithms - discuss use cases for quantum algorithms - describe quantum sensors and their applications - discuss ethical aspects of quantum technologies - discuss the certification of quantum technologies
Course contents	- quantum computing, quantum cryptography and quantum sensing - complex valued linear algebra - foundations of quantum information - BB84-protocol - E91-protcol - free space and fiber based implementation of QKD - hardware for quantum computers - quantum algorithms - quantum sensors - ethical aspects of quantum technologies - certification of quantum technologies
Prerequisites	none
Assessment Methods	- moodle tests - student's presentations

	- final exam
Recommended Reading and Material	- Müller/Greinert: Quantentechnologien für Ingenieure - Wong: Introduction to Classical and Quantum Computing
Attendance	75%
Comments	

Quantum Information Laboratory

Degree programme	MIB
Semester	3
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	This course complements the course Introduction to Quantum information by demonstarting and conducting hands-on experiments in which we produce, manipulate and detect qubits.
Teaching methods	Lecture, discussion, independent conduct of experiments
Learning outcome	After passing this course successfully students are able to ... - work in a physics laboratory - work safely with laser radiation - take data and evaluate measurement results - understand concepts like superposition and interference - understand entanglement and how entangled states can be produced - know about the polarization of photons and its manipulation - know and apply protocols to distribute quantum keys
Course contents	- Laser safety - Lasers and detectors - Double slit experiment, diffraction at a grating - Interference and interferometers - Entanglement and Bell inequality - Quantum key distribution: BB84 protocol
Prerequisites	Introduction to Quantum information (class 1 and 2)
Assessment Methods	- Laser safety test (10%) - Lab Reports (90%)

Recommended Reading and Material	- Rainer Müller, Franziska Greinert: Quantentechnologien für Ingenieure (2023)
Attendance	Presence during the classes is obligatory and will be monitored. At least 75% of the classes must be attended in order to pass the course.
Comments	

Managerial Economics and Operations Research

Degree programme	MIB
Semester	3
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Power Electronics (MLE)

Societal Impact Studies

Degree programme	MLE
Semester	3
Course methods	SE
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	We aim at assessing problem areas in a society which increasingly depends on electronic communication systems
Teaching methods	Seminar
Learning outcome	After passing this course successfully students are able to ... - recognize potential sources of error in electronic systems and to evaluate their impacts on safety - analyse the opportunities and limitations of automation - evaluate the loss of privacy in electronic communication systems - propose countermeasures to government surveillance

Course contents	- Case studies of safety in avation and public transport systems - Automation of aviation and rail transport - Autonomous vehicles - Smart Homes – Internet of Things - Case studies of government surveillance - Limitation of privacy and citizen’s rights
Prerequisites	Completion of previous semester course
Assessment Methods	- Assessment of quality of the student's in-class participation, and of the presentation of a term paper.
Recommended Reading and Material	- Maderdonner, O. / et al (2014): Privacy, Skriptum - Additional current handouts and audio-visual support
Attendance	Attendance is compulsory
Comments	

Innovation and Technology Management (MTM)

Empirical Market Research

Degree programme	MTM
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	In this course, students acquire basic knowledge and skills in the field of empirical marketing research.
Teaching methods	Self-study, lecture, discussion, exercises, field work in groups (own marketing research project with interviews, survey)
Learning outcome	After passing this course successfully students are able to ... - outline objects of cognition and functions of marketing research - plan and manage a marketing research project - distinguish between in-house research and third-party research - distinguish between primary and secondary research; big data, social media data - decide whether to use quantitative or qualitative research techniques

	- explain measurement concepts and design questionnaires or online-surveys - draw a sample and distinguish sample from census - conduct field work, i.e. run a survey and assure data quality - analyse data, interpret and present marketing research results for decision making
Course contents	- marketing research process, functions and uses - defining the research problem, formulating research objectives, research proposal - research design and application: exploratory, descriptive or causal research - in-house research versus third-party research - primary versus secondary data; big data, social media data - research techniques: quantitative versus qualitative; marketing research online-communities - basic modes and types for gathering survey data: personal interviews, telephone interviews, online surveys, focus groups - data measurement (nominal, ordnial, scale measures) and questionnaire development - basic concepts involved with sampling and axioms about sample size - field work and data quality issues - data analysis: qualitative (analysis of topics, grounded theory) and quantitative (descriptive statistics, inference analysis) methods - marketing research report, visuals, oral presentation and discussion of results
Prerequisites	Basic knowledge in scientific work
Assessment Methods	- Moodle-Quiz (30%) + elaboration of a marketing research study (70%)
Recommended Reading and Material	- Burns/Veek/Bush: Marketing Research, 9th Global Edition, Pearson Education Ltd. 2020 - Pecher: Marketing Research - Script on Approaches, Research Concepts, Quantitative and Qualitative Methods as well as Analysis Techniques, V02 of August 2020
Attendance	In general, attendance is not mandatory.
Comments	

Enterprise Simulation

Degree programme	MTM
Semester	3
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Innovation and Technologie Management

Degree programme	MTM
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Digital Leadership & New World of Work

Degree programme	MTM
Semester	3
Course methods	UE
Language	English
ECTS Credits	5.00
Incoming places	Limited

Software Engineering (MSE)

Introduction to Graph-Database

Degree programme	MSE
Semester	3
Course methods	ILV, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The goal of this course is to introduce the studentsinto the main concepts related to graph databases (GDB), with emphasis in Neo4j.The first (online, face-to-face) part of the course will introduce the context forGDB, and how they situate within the NoSQL paradigm. The main concepts,tools, and techniques for GDB will be studied, with emphasis in the propertygraph data model and Neo4j (and its accompanying query language, Cypher).RDF triple stores will be covered, as an alternative to the property graph data model. The offline part of the course consists in assignments related to querying graph databases.
Teaching methods	Online face-t-face lectures and take-home assignments.
Learning outcome	After passing this course successfully students are able to ... - Design and query graph databases
Course contents	
Prerequisites	Knowledge of databases at an intermediate level.
Assessment Methods	- Exam at the endo of the online part (40%), two projects for the offline part (60%)
Recommended Reading and Material	- A. Vaisman and E. Zimányi. Data Warehouse Systems: Design and Implementation, 2nd Edition, Chapter 13, Springer, 2022 - Ian Robinson, Jim Webber, and Emil Eifrem. Graph Databases. O'Reilly Media, Inc., 2013 - Bechberger, D. Graph Databases in Action, Manning, 2020.
Attendance	Mandatory (75%) for the face-to-face online part.
Comments	

Healthcare and Rehabilitation Technology (MGR)

Current Topics in Rehabilitation Engineering

Degree programme	MGR
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course, students will attend a series of expert lectures from the entire field of Life Science Engineering. Their contents are supplemented by current scientific literature in self-study and give students a comprehensive overview of current topics in Life Science Engineering.
Teaching methods	Expert lectures, self-study with current articles and videos, feedback from lecturers, peer-review.
Learning outcome	After passing this course successfully students are able to ... - ...name different research topics in the field of Life Science Engineering. - ...conduct research on selected research topics in the field of Life Science Engineering. - ...explain the results of research in the form of a short video.
Course contents	- Overview of tasks and activities in the subject areas of the study programme and beyond
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Introduction to MATLAB for Applications in Life Sciences

Degree programme	MGR
Semester	1
Course methods	SO
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	The course focuses on building a strong foundation of programming in MATLAB. Additionally, the basics of signal processing and the design of graphical user interfaces are covered. At the end of the course, students should be able to use MATLAB confidently for their work and be prepared to deepen their skills in the subsequent course MLS 2. Each lesson includes an interactive introduction of the theory

	followed by practical assignments ranging in difficulty. Additional topics can be introduced into the course setup upon request.
Teaching methods	Presentation of lecturers and contribution of students
Learning outcome	After passing this course successfully students are able to ... - Work with various data types in MATLAB - Use logical operations, arithmetic operations and algorithm control structures - Write scripts, functions and algorithm flow charts - Operate with selected I/O file types and visualise data - Create GUIs
Course contents	- MATLAB data types - Control structures, logical and arithmetic operators - Scripts and functions - Data visualisation - Script debugging and flow charts - Signal processing introduction - Graphical User Interfaces
Prerequisites	Basic programming knowledge. General knowledge from the field of Life Sciences on a Bachelor level.
Assessment Methods	- Contribution during lectures, individual assignments
Recommended Reading and Material	- [1] S. Attaway, MATLAB. A Practical Introduction to Programming and Problem Solving. London: Butterworth-Heinemann, 2013. - [2] A. B. Biran, What Every Engineer Should Know About Matlab and Simulink. New York: Taylor & Francis Group, 2010.
Attendance	Attendance is optional
Comments	

Internet of Things and Smart Systems (MIO)

Innovation- and Technologymanagement

Degree programme	MIO
Semester	1
Course methods	SE
Language	English

ECTS Credits	5.00
Incoming places	Limited
Course description	The course "Innovation- and Technologymanagement" offers you on the one hand current theory and practical examples of IT innovations, on the other hand you apply the learned theoretical knowledge practically by working on a problem defined by our corporate partner. This dual teaching approach provides the opportunity to learn practical skills in innovation development, prototyping and iterative work through user research to finally critically discuss solutions. At the end of the course, you will be proud of two outcomes: One, you will have developed and presented a prototype to solve our corporate partner's challenge. The core is the design of an innovation strategy, the creation of an implementation concept including accompanying measures based on a prototype. On the other hand, you will have written an individual knowledge contribution about an innovation or technology application.
Teaching methods	Theory input from the lecturerGroup work with a predefined problem of a companyDiscussion roundsWritten elaboration and reflection of contents
Learning outcome	Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ... - plan and execute innovation strategies and processes - critically discuss IT innovation tools and theories - conduct a design sprint that specifically includes prototyping, user research, and iterative innovation processes - evaluate and develop emerging technologies that induce innovation
Course contents	- Design thinking and design sprints - Iterative work based on prototyping: from paper to digital prototypes - Innovation organization & processes: Design of innovation processes and their implementation using concrete company examples. - Theories (e.g. innovator's dilemma, open innovation, user lead innovation as well as co-creation approaches) - Technology-induced innovation: models for evaluating technologies, technology radar, uncovering future trends - Tools of IT innovation: playful approaches to IT innovation, innovation games; application of creativity techniques
Prerequisites	none
Assessment Methods	- Case Study "Innovation in an incumbent corporate": Application of

	theoretical knowledge in a practical application case; 50% of the total grade (group assessment) - Creation of a knowledge contribution: 20% of the total grade (individual performance) - Multiple Choice Exam 30% of the grade (individual performance)
Recommended Reading and Material	- Franken, R., & Franken, S. (2020). Wissen, Lernen und Innovation im digitalen Unternehmen (Vol. 2). Mit Fallstudien und Praxisbeispielen. Springer Gabler, Wiesbaden - Bodemann, M., Fellner, W., & Just, V. (2021). Zukunftsfähigkeit durch Innovation, Digitalisierung und Technologien: Geschäftsmodelle und Unternehmenspraxis im Wandel, Springer Gabler, Wiesbaden
Attendance	The course will be taught at FH Technikum Wien. Collaboration tools will be integrated into the course sessions (e.g. lectures, group work). Moreover, the assessment methods (e.g. presentations, assignment) will be handled via Moodle. The current attendance rules are in effect.
Comments	-

IoT System Models

Degree programme	MIO
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The IoT System Models course covers the processing of the theoretical basis for the analysis and development of IoT systems.
Teaching methods	This ILV has been developed according to the "Constructive Alignment" principle. Each topic is processed in a distance learning and in a presence phase. These two phases complete each other and the main method in this ILV is "learning by doing". The distance learning is worked out by the students in self-study. Questions and open points are discussed in regular forums and meetings with the lecturer. In the attendance phase, the results of the distance learning

	are to be presented and the following topic is to be conveyed in the form of an impulse lecture.
Learning outcome	Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ... - explain basic concepts and terms of IoT systems, - categorize and define IoT systems, - define common basic elements, properties and interfaces of IoT systems, - describe basics of Operation Technologies (OT) such as automation pyramid architecture as a basis for IIoT architectures, - understand and interpret key IoT standards and norms, - explain essential technologies on which IoT architectures are built (e.g. sensors, gateway, IT server, database), - specify requirements for the real-time capability (Real Time Operation) reliability, availability and safety (Security and Functional Safety) of IoT systems, - Specify elementary application-specific system architecture, define its interfaces, and implement it in the lab.
Course contents	- Introduction to IoT systems (definition, history, application areas, ...) - Categorization of IoT systems (Industrial IoT, Home Automation, ...) - Architecture of IoT systems (general and application-specific) - Infrastructure fundamentals - Standardization - Real-time capability - Fail-safe - Team project
Prerequisites	Basic knowledge according to acceptence criteria
Assessment Methods	- Immanent performance review (active participation/intermediate tests, 20%) - Team project, 40% (e.g., specify system architecture, define its interfaces, and present it as a team). - Final exam (theory, practical tasks, 40%)
Recommended Reading and Material	- Prof. Dr. rer. nat. Felix Hüning (2018), Embedded Systems für IoT, Springer Vieweg, © Springer-Verlag GmbH Deutschland - Prof. Dr. Steffen Wendzel (2018), IT-Sicherheit für TCP/IP- und IoT-Netzwerke, Springer Vieweg, © Springer-Verlag GmbH Deutschland - David Hanes, Gonzalo Salgueiro et. al., IoT Fundamentals, Cisco Press, ISBN-13: 978-1-58714-456-1, 2017 Cisco Systems
Attendance	Optional (with full attendance + 20% from active participation).
Comments	

Digital Leadership

Degree programme	MIO
Semester	3
Course methods	SE
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course will provide an overview of the latest practical and theoretical leadership concepts. Students will gain practical insights into the challenges of leadership and transformation, for example, in international organizations, and they will also develop new perspectives on the contemporary world of work and the theme of leadership. One of the course's fundamental components will be a student created reflection on specific issues concerning leadership and their implementation.
Teaching methods	
Learning outcome	Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ... - identify and explain the tasks and instruments of leadership (for example, delegation, agreement on objectives) as well as to explain classical management models (for example, the leading continuum, the maturity model), to weigh the advantages and disadvantages of different leadership theories and concepts and to apply these to practical examples - describe agile leadership (e.g. in expert organisations, transformation processes) and use it as an example of leadership - explain the exact, academic, understanding of digital leadership (e.g. coaching culture) and apply this concept to specific cases - apply the systemic loop (from the perspective of a leadership position) in a theoretical manner to interdisciplinary or intercultural teams - understand the essential techniques of leadership in an intercultural context - outline the most important trends in the labour market - motivate employees and lead virtual teams in an increasingly digitalized world of work

Course contents	- Fundamentals of leadership, traditional traits, behavioural and situational theories of leadership - Systems theory in social systems - Leadership in a digital context - Modern leadership concepts (agile leadership, transformational leadership, servant leadership and other such theories) - Interdisciplinarity and interculturality - Trends in the economy: the labour market, globalisation, digital transformation and Industry 4.0 - The specifics of leading teams of experts
Prerequisites	
Assessment Methods	- Participation in workshops, exercises, case studies, written exam
Recommended Reading and Material	- Berninger-Schäfer, E. (2019): Digital Leadership; Die Digitalisierung der Führung, managerSeminare Verlags GmbH - Franken, S. (2019): Verhaltensorientierte Führung; Handeln, Lernen und Ethik im Unternehmen, 4. Auflage, Gabler - Gasteiger, R., Kaschube, J., Rathjen, Ph. (2016): Interkulturelle Führung in Organisationen, Menschen in globalen Kontexten effektiv führen, essentials Springer Gabal - Greßer, K., Freisler, R. (2020): Ready for Transformation; Neue Arbeitswelt, digital und agil…, managerSeminare Verlags GmbH - Lerch, Sebastian (2017): Interdisziplinäre Kompetenzen, UTB - Lüthi, E., Oberpriller, H., Loose, A., Orths, St. (2013): Teamentwicklung mit Diversity Management, Haupt - Wunderer, R. (2011): Führung und Zusammenarbeit, Eine unternehmerische Führungslehre, 9. Auflage, Luchterhand
Attendance	Attendance is compulsory.
Comments	

Automation

Degree programme	MIO
Semester	3
Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...
- interpret function charts, ladder diagrams, and instruction list
- identify individual components of an automated system
- apply planning tools of automation technology
- network control technology components
- apply basic control engineering circuits.
- explain basic building technology circuits and functions: o Blind, shutter, awning, sunshade controls o Automatic window and door controls (locking technology)
- apply lighting components
- recognize limitations, problems and dangers of automation systems

Course contents

- Switch-on delay, switch-off delay, staircase automat, comfort switching
- Circuits and components from practice (e.g. counter for wind measurement, anti-ice function for roller shutters, temperature sensors, motion detectors, humidity sensor)
- Control of ventilation technology, dehumidification technology
- Linking of individual elements and the problems behind it
- Automatic doors and gate controls
- Plant engineering in the industry
- Autonomous driving with guidance systems in / on the ground or with AI
- Basics of engine control units - characteristics and control of the individual types
- Problems of instability of controls in large plants
- Manipulated variable and its significance in building services engineering
- Manipulated variable and its significance in building technologyMaintenance and repair, troubleshooting and analysis

Prerequisites

Assessment Methods

- Ongoing practical examples and final theoretical exam

Recommended Reading and Material

- Heinrich, Linke, Glöckler (2020): Grundlagen Automatisierung, Springer Verlag.
- V. Plenk, Grundlagen der Automatisierungstechnik kompakt, Springer Verlag Vieweg, 2019.
- Wellenreuther, Zastrow (2015): Automatisieren mit SPS, Springer Vieweg.
- Tapken (2020): SPS – Theorie und Praxis, Europa-Lehrmittel.

- C. Karaali, Grundlagen der Steuerungstechnik, Springer Verlag Vieweg, 2018.

Attendance

Comments

Data Management

Degree programme	MIO
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

This course provides an introduction to data storage in the backend/cloud. In addition to classic file formats for structured data, SQL-based and non-SQL-based database systems are discussed.

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...
- Explain database terms and technologies and install or configure selected database systems.
- Create logical data models, map them to a database system and record sensor data with them.
- Apply queries on single and compound tables and perform simple arithmetic operations using SQL.
- Create XML and JSON-based data and import it into or retrieve it from databases.
- Create a cloud service to persist and deliver Internet-of-Things data (IoT streams) and explore them with selected web-based tools.
- Configure a Big Data infrastructure for time series data and use it to record, read, or examine sensor data.
- Execute ready-made scripts (SQL, Python) or adapt them for given tasks in the field of data management.

Course contents

- Database Basics and Technologies
- Data modeling and database creation
- Data manipulation
- Queries using SQL
- XML and JSON

	- NoSQL databases for time series data - Big Data Infrastructures
Prerequisites	
Assessment Methods	- 3 partial exams (100%)
Recommended Reading and Material	
Attendance	
Comments	

IoT Operating Systems

Degree programme	MIO
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	In this course IoT operating systems will be discussed. We start with a short review of bare-metal microcontroller programming in C (ESP32), followed by the programming of FreeRTOS based sensor nodes (ESP32), concluding the lecture with Linux as operating system for gateways and servers.
Teaching methods	This course employs theory lecture's, practical demonstrations and practical exercises.
Learning outcome	Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ... - explain basic operating system functions, such as the process model and virtual memory management. - use Linux systems via the command line, as well as automate more complex tasks with shell scripts. - configure the network stack of Linux systems. - configure persistent mass storage (HDDs, SSDs, e.g.) on Linux systems. - implement container virtualization on Linux. - explain the similarities and differences between General Purpose Operating System (GPOS) and Real Time Operating System (RTOS).

	- select the appropriate RTOS services, task models, scheduling methods and design patterns for embedded software applications and to employ debugging strategies for embedded real-time operating systems.
Course contents	- Operating systems basics (processes, memory management) - Shell and system programs - GNU/Linux installation (boot process on ARM and x86 architectures, block devices, file systems) - GNU/Linux configuration (user management, network stack) - Basics of virtualization (virtual machines, containers, virtual networks) - GPOS vs. RTOS, RTOS characteristics - Tasks and scheduling in RTOS - Intertask Communication and Synchronization - Exception processing (exceptions, interrupts) - Timer and Timer Services - Task models, cycle-based scheduling
Prerequisites	Microcontroller programming in CUser knowledge in Linux
Assessment Methods	- Weekly homework - Two written exams
Recommended Reading and Material	
Attendance	optional
Comments	

Networking

Degree programme	MIO
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course discusses network technologies that form the basis for data communication in IoT systems.
Teaching methods	

Learning outcome	Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ... - plan, describe and apply architecture, protocol stacks, interfaces, addresses, routing, ... of IPv4 networks. - describe the basic network architectures and communication protocols used in LANs and WANs, reference models, and their message flows. - name and explain routing concepts, DNS, DHCP, firewalls, ACLs. - simulate/emulate IP networks and protocols in a simulation environment. - explain the operation of internetworking devices (hub, switch, router) - explain the concepts of NFV, SDN, and the "cloudification" of communication networks. - configure network elements in a simulator or in practice - configure and operate server infrastructure for network services - analyze protocol headers - apply network standard tools such as Wireshark and PuTTY
Course contents	- Reference models (OSI, TCP/IP), network architectures and communication protocols in LANs and WANs - Message flows in communication networks - Configuration of network elements and server infrastructures - Planning of LANs and IP networks (TCP/IP) - Configure and manage DNS and DHCP servers - Configuration of Firewalls and ACLs - Routing, Internetworking - Simulation of LANs and IP networks - Functional analysis and troubleshooting in LANs - NFV and SDN
Prerequisites	
Assessment Methods	- Assessment of laboratory exercises/simulation exercises documented by students in laboratory protocols. - Presentation of a relevant topic - Moodle-Quiz - Oral examination
Recommended Reading and Material	
Attendance	
Comments	

Advanced IoT Operating Systems

Degree programme	MIO
Semester	3
Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...
- create virtual computer networks under Linux
- limit the memory consumption of processes under Linux with CGROUPS
- implement basic network services (DNS, Web, SSH servers) on Linux systems
- implement network services in containers
- use configuration management tools to manage remote systems
- implement practical applications using different RTOS techniques

Course contents

- virtual network interfaces under Linux
- resource management with CGROUPS under Linux
- basic network services (DNS, web, SSH servers)
- creating and operating containers under Linux
- use of configuration management tools
- software design for data throughput (interrupt frequency, pipelined software, DMA, ...)
- buffering, producer-consumer problem
- interprocess-communication and synchronization
- scheduling strategies, deadlock prevention
- memory management, prevention of "memory leaks"

Prerequisites	programming basics, operating systems basics
Assessment Methods	- course immanent performance assessment and final examination
Recommended Reading and Material	- lectures notes

Attendance

Advanced IoT Systems Development

Degree programme	MIO
Semester	3
Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	
Teaching methods	
Learning outcome	Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ... - design, implement, and optimize end-to-end IoT systems. - select appropriate algorithms and architectures to implement distributed IoT systems. - select and use suitable cloud backends
Course contents	- design & programming of distributed IoT overall systems - selection of suitable components and tools - Comparison and selection of algorithms - distributed calculations in the overall system - evaluation of different solution approaches and selection of the appropriate architecture - optimization of the algorithms, the communication structure and the overall architecture
Prerequisites	
Assessment Methods	- course immanent performance assessment and final examination
Recommended Reading and Material	
Attendance	
Comments	

Sensor Data Analytics

Degree programme	MIO
Semester	3

Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...
- provide an overview of the fields of Artificial Intelligence, Machine Learning and Data Science.
- process sensor data and store it in different densities
- explore and visualize sensor data or identify and correct data problems (measurement errors).
- analyze time series data using hypothesis testing and build predictive models based on statistical techniques
- design and train a Recurrent Neural Network with selected libraries
- develop predictive models for sensor data based on machine learning techniques.
- apply pattern recognition to sensor data to identify defined events
- execute ready-made scripts (SQL, Python) or adapt them for given tasks in the field of data management.

Course contents

- Sensor Data Engineering
- Preparation, visualization and evaluation of sensor data
- Data quality and outlier detection
- Statistical methods for time series
- Recurrent Neural Networks
- Machine learning method for sensor data
- Predictive analytics using pattern recognition

Prerequisites

Assessment Methods

- Immanent performance review (intermediate tests, 30%)
- Final exam (theory, practical tasks, 70%)

Recommended Reading and Material

- Burkov, A. (2019). The Hundred-Page Machine Learning Book. Burkov

Attendance

Comments