UAS Technikum Wien

COURSE GUIDE WS2023/24

COURSES OFFERED IN ENGLISH

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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!
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OVERVIEW OF COURSES OFFERED ENTIRELY IN ENGLISH

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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
Electronic Engineering	BEL
Electronics and Business	BEW
Information and Communication Systems and Services	BIC
Computer Science	BIF
International Business & Engineering	BIW
Mechanical Engineering	BMB
Mechatronics/Robotics	BMR
Smart Homes and Assistive Technologies	BSA
Human Factors and Sports	BHF

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
IT Security	MCS
Power Electronics	MLE
Industrial Engineering & Business	MIB
Mechanical Engineering	MMB
Robotics Engineering	MRE
Integrative Urban Development – Smart City	MSC
Software Engineering	MSE
Sports Equipment Technology	MST
Tissues Engineering and Regenerative Medicine	MTE
Internet of Things and Smart Systems	MIO
Innovation and Technology Management	MTM
Environmental Management and Ecotoxicology	MUT
Information Systems Management	MWI

CAMPUS INTERNATIONAL

Campus International (ECI)

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

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
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) - Core B2 English language work
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	

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	

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_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_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,

	- record sounds using the appropriate equipment, - measure different attributes of sound, - analyse and interpret recorded sounds, - synthesise and manipulate sounds with specific attributes, - perform audio processing on recordings, - understand how audio compression works.
Course contents	- Sound and sound attributes - Signal chain in audio engineering - Microphones and amplifiers - Analog vs digital signals and conversion - Fourier Analysis, Spectrum, Spectrogram - Synthesis of sounds - Filters - Audio compression - Lourspeakers - Soundcard
Prerequisites	Basic programming skills. Matlab knowledge advantageous.
Assessment Methods	- The students will hand in assignments that have to do with the topics discussed in the lecture.
Recommended Reading and Material	
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_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	

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_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_Cooperative International Student Project

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 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_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 B1

Degree programme	ECI

Semester	0
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

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	

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://youtu.be/oN9UciVc-2I
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 online 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	

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 and Material	- Ethics Advisory Group (2018): Ethics Advisory Group Report 2018 - 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.

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 the main components of mobile robots. The students achieve a basic understanding of methods to control mobile robots and implement behaviours as well as methods for direct sensor-actor coupling.The knowledge learned is first applied in a simulation environment and finally tested on a real robot.
Teaching methods	The learning content is explained using PDF slides and Jupyter notebooks. Afterwards, the students are divided into groups and carry out a project independently with the help of the lecturer.
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

	- control mobile robots by applying behaviour methods for direct sensor-actor coupling - apply basic knowledge ROS
Course contents	- Introduction to Mobile Robotics - Develop ROS nodes for robot applications
Prerequisites	Mandatory: Programming in C++ and/or Python; Basic Linux Skills (there are warm-up slides) | Recommended: Computer Vision Basics
Assessment Methods	- Homework: 20% - Moodle Quizzes: 20% - Moodle Forum: 5% - Projekt: 55%
Recommended Reading and Material	- O'Kane: A Gentle Introduction To ROS, 2.1.6, 2018, https://www.cse.sc.edu/~jokane/agitr/ - http://wiki.ros.org/
Attendance	
Comments	This course requires a (reasonably) powerful computer:- min i5 (7th gen.)- 8GB RAM (Ubuntu) | 16GB RAM (Windows)

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 discusses main concepts of robot programming including different concepts for software development. This includes programming, concepts and methods, in particular ROS (robot operating system as a stadnardized framework for personal robots).
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 - control mobile robots by applying behaviour methods for direct sensor-actor coupling - explain principles and applications of machine vision - clarify concepts of probabilistic robotics and apply respective algorithms - explain and design machine learning applications for object detection
Course contents	- Short outline of basic robot programming conceptsmased on a robot's kinematics, actors sensors and control concepts - C++ - ROS
Prerequisites	Mandatory: - Sensor technology - Basic programming skills, in particular in C - Sensor technology
Assessment Methods	- 70% final exam - 30% exercises
Recommended Reading and Material	- http://wiki.ros.org/ROS/Tutorials - Bishop, C.M.; Pattern Recognition and Machine Learning, 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 exam.
Comments	

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

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.

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 topics such as automization, digitalization, machines and materials and 3D Printing. 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	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	- Future Trends in Technology (automization, digitalization, machines and materials, 3D printing, AI, and the internet of things.) - Visualizing technical descriptions - Describing technical visualizations - Technical object descriptions - Technical process descriptions

	- Technical English talk
Prerequisites	B2 level English
Assessment Methods	- 40% Process Description Presentation - 40% Process Description Writing Task - 20% Completion of Self-Study Tasks
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	- test, assessment of the submission of individual tasks and projects
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

Biomedical Engineering (BBE)

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 Engineering Projects

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

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	

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. Their contents are

	supplemented by current scientific literature in self-study and give students a comprehensive overview of current topics in Life Science Engineering. Groups of students from different study programmes will cooperate during the semester in creating a video explaining selected scientific concepts.
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	

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	

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	

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	

Mobile Computing in Medical Applications

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

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	

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	

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 - Communication via extracellular vesicles
Prerequisites	Cell Culture TechniquesCel culture LabMolecular Genetics
Assessment Methods	- Entrance tests, group work, 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	

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	

Active 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	

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	

Neural Engineering

Degree programme	BBE
Semester	5

Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

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	

Photonics in Biomedical Engineering

Degree programme	BBE
Semester	5
Course methods	ILV
Language	English
ECTS Credits	2.00
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 topics such as automization, digitalization, machines and materials and 3D Printing. 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	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	- Future Trends in Technology (automization, digitalization, machines and materials, 3D printing, AI, and the internet of things.) - Visualizing technical descriptions - Describing technical visualizations - Technical object descriptions - Technical process descriptions - Technical English talk
Prerequisites	B2 level English
Assessment Methods	- 40% Process Description Presentation - 40% Process Description Writing Task - 20% Completion of Self-Study Tasks
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	

Smart Homes and Assistive Technologies (BSA)

IT Security Basics

Degree programme	BSA
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	

Software Security

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

Course description	Introduction to the basic aspects of IT security with special focus on network security
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - Implement protection goals for wireless and wired networks - create concepts for the protection of sensitive information in applications - To establish Identity & Access Management in web applications the more the security standard is increased (system hardening). - to transfer security topics from the web environment to requirements from the cloud - Administrate security systems - to assess IT security of systems - Ensure confidentiality and integrity of data in transfer
Course contents	- Cryptographic methods and their practical application - Protection of wired and wireless networks - Transport layer security and virtual private networks - Protection of mobile devices - Web Application Security - Identity & Access Management - Data protection and data security on the web - Management of security systems - Hardening of systems - Cloud Security
Prerequisites	
Assessment Methods	
Recommended Reading and Material	

Attendance	
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 topics such as automization, digitalization, machines and materials and 3D Printing. 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	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	- Future Trends in Technology (automization, digitalization, machines and materials, 3D printing, AI, and the internet of things.) - Visualizing technical descriptions - Describing technical visualizations - Technical object descriptions - Technical process descriptions - Technical English talk

Prerequisites	B2 level English
Assessment Methods	- 40% Process Description Presentation - 40% Process Description Writing Task - 20% Completion of Self-Study Tasks
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	

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	

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	

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 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	

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	

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	

Electronics and Business (BEW)

Electronic Project 1

Degree programme	BEW
Semester	3
Course methods	FUV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	Application of electronic design to develop an electronic device in a project environment. Theme audio electronics
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - apply active and passive electronic components - design and simulate electronic circuits - assemble prototypes, to operate and measure them - work in a project environment - analyse data sheets - write technical documentations
Course contents	- Audio measurement - Audio Amplifier - MOSFET circuits - Analog filter - AD converter

	- OPV circuits
Prerequisites	Circuit design
Assessment Methods	- Course immanent assessment method - Technical documentation - Individual examination of circuit and measurement knowledge - Working prototype
Recommended Reading and Material	- Böhmer, Erwin (2009): Elemente der angewandten Elektronik, Vieweg - Maxfield / Bird / Williams / Kester (2008): Electrical Engineering: Know It All, Elsevier - Tietze, Ulrich / Schenk, Christoph / Gamm, Eberhard (1999): Halbleiter – Schaltungstechnik, Springer - Scripts
Attendance	compulsory attendance during on-campus phases
Comments	

Embedded Systems

Degree programme	BEW
Semester	3
Course methods	FUV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	This class teaches the basics in microcontroller programming on system level (µCLinux).
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe basic functionalities and parts of a microcontroller - utilize basic peripherals of a microcontroller (GPIO, timer, ADC, etc.) - develop applications in uCLinux and identify the main differences to a generic purpose operating system (Linux)
Course contents	- Cross compiling of applications for µCLinux - GPIO - Timer

	- Interrupts - ADC
Prerequisites	- Programming with C- Basics in system programming (Linux)- Makefiles
Assessment Methods	- Course immanent assessment method and end exam
Recommended Reading and Material	- Embedded Artists AB, (2009): “Getting started with µCLinux Development”, Embedded Artists AB - Trevor Martin BSc. (hons) CEng. MIEE, (2006): “Insiders Guide To The Philips ARM7 Based Microcontrollers”, Hitex - Internal distance learning letters
Attendance	During on-campus phases of the course attendance is compulsory
Comments	

Physics 2

Degree programme	BEW
Semester	3
Course methods	FUV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	Course focuses on growth phenomena, oscillations with prospects to wave phenomena, transport phenomena as thermal conductivity effects.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe physical Problems - do modelling, mathematical solution and interpretation of results - use of scientific literature
Course contents	- Electricity - Magnetism - Growth Effects - Oscillation - Prospects to wave phenomena and transport phenomena as thermal conductivity effects - Uncertainty in Measurement Results

Prerequisites	Elementary physics and mathematics
Assessment Methods	- Course immanent assessment method and end exam
Recommended Reading and Material	- Gerthsen: Physik - Tipler: Physik - Handouts - Web
Attendance	compulsory attendance during on-campus phases
Comments	

Computer Science 3

Degree programme	BEW
Semester	3
Course methods	FUV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	This lecture covers the basics of operating systems and system programming
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - implement programs that interact with the file system and the environment variables of a unix operating system - explain and evaluate important concepts like threads and processes - evaluate programs involving interprecess communications and modify them
Course contents	- File I/O and buffered I/O - Process management - Interprocess communication - Signal Handling - Threads - Time Measurement - Pipes
Prerequisites	The lectures Computer Science 1 & 2, in general a good knowledge of the programming language C and hardware architecture.

Assessment Methods	- 1 written exam and labworks (8 exercises, submitted weekly)
Recommended Reading and Material	- - Linux System Programming, Robert Love, O'Reilly Media, 1st Edition, 2007, 369 pages
Attendance	Compulsory attendance during on-campus phases
Comments	

Economics, Technology and Society

Degree programme	BEW
Semester	3
Course methods	FUV
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	Starting from the Common European Framework of Reference for Languages B2, students engage with global economic and technical developments and their impact on society, and thereby acquire relevant terms and concepts together with the appropriate language skills
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - recognize connections between economic theories and forms of government - analyse the impact of globalization on society and the Environment - compare and contrast corporate innovation models
Course contents	- Economic concepts and theories - Winners and losers of globalization - Development of Technologies - Innovation
Prerequisites	Completion of previous course
Assessment Methods	- Course immanent assessment method, i.e. active participation in class activities and timely completion of assignments
Recommended Reading and Material	- Maderdonner, O. / et al (2014): Economy, Technology and Society, Skriptum - Additional current handouts and audio-visual support

Attendance	compulsory attendance during on-campus phases
Comments	

Business Administration 1

Degree programme	BEW
Semester	3
Course methods	FUV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	The course is divided into two parts:Accounting: This part of the course provides an understanding of the use of accounting information by management in planning and controlling a biz. It will help students perform financial analysis, derive information for personal or organizational decisions, understand the language of business.Marketing: Marketing is a management approach, which makes sure, that most of a companies activities are based on meeting a given target. The core of today marketing is the systematic alignment of all company functions towards the needs of the end user.
Teaching methods	Introduction in the first presence session and recommendation of literature for self-study; weekly online tests in Moodle; weekly individual and group exercises; final exam with single/multiple choice questions, essays.
Learning outcome	After passing this course successfully students are able to ... - Accounting: - •explain key terms of accounting - •prepare a simple set of financial statements including year end adjustments such as depreciation, accruals, bad debts, etc. - •to exam financial accounts to be able to explain the performance of a company using ratio analysis - Marketing: - •analyse the professional problems in the area of marketing and to give solutions to selected practical Problems - •understand and manage the needs of Marketing in cooperation with the professional environment in a Company

Course contents	- Accounting: - •Purpose of accounting - •Key terms in financial accounting - •Recording data (double-entry book-keeping) - •Preparing financial statements (Balance sheet, income statement) - •Interpretation of Accounts - Marketing: - •Marketing Basics - •Competetive strategies - •4 P's (Product, Place, Price, Promotion)
Prerequisites	none
Assessment Methods	- •Accounting: Individual und group assignments - •Marketing: Individual and group assignments - •Continuous Assessment (Moodle Test) - •Final Exam
Recommended Reading and Material	- •Marketing: Essentials of Marketing by Brassington/Pettitt - •Accounting: Accounting for non-accounting students (John R.Dyson)
Attendance	Compulsory attendance during on-campus phases
Comments	

Presentation Skills and Communication

Degree programme	BEW
Semester	3
Course methods	FUV
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	In the course the students learn to present issues and facts in a target oriented way.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - analyse the target group and to define objectives of a presentation. - prepare a presentation of simple technical issues to specific target groups (especially for "non-technicians") by means of appropriate

	techniques (e.g. reduction, visualization). - plan the dramaturgy of a presentation using different design elements (e.g. forms of entry and exit).
Course contents	- Target group and goals - Preparation, structuring and reduction of presentation contents - Visualization - Creation of a presentation
Prerequisites	none
Assessment Methods	- Course immanent assessment method
Recommended Reading and Material	- Harvard Business - The Results-driven Manager (2004): Presentations that Persuade and Motivate, Boston, Harvard Business School Press
Attendance	Distance learning
Comments	

Advanced Technical Communication and Engineering Ethics

Degree programme	BEW
Semester	5
Course methods	FUV
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	Starting from the Common European Framework of Reference for Languages C1, students discuss ethics concepts and analyze real-life case studies, as well as work on the formal aspects of technical and scientific texts
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - formulate and justify a rationally defendable position on basic ethical Problems - analyze ethical dilemmas in case studies - identify given formal and language-related features of technical and scientific texts - apply given formal and language-related features of technical and scientific texts

Course contents	- Principles of ethical judgement - Case studies - Formal and language-related aspects of technical and scientific texts - 30 seconds speeches
Prerequisites	Common European Framework of Reference for Languages Level C1 Completion of previous semester course
Assessment Methods	- Course immanent assessment method, i.e. active participation in class activities and timely completion of assignments
Recommended Reading and Material	- Connolly, P. / Kingsbury, P. et al. (2014): eSNACK, Lernplattform - Schökler, G. (2014): Einzelskripten, adapted from Maderdonner, O. / et al (2014): Ethics, Skriptum - Additional current handouts and audio-visual support
Attendance	compulsory attendance during on-campus phases
Comments	

Business Management

Degree programme	BEW
Semester	5
Course methods	FUV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	The course shall provide an overview over the essential elements of Business Management in order to prepare the students for managerial tasks in practical business life. After an introduction to the basics of management (Definition of management, tasks and required skills of managers, environment, social responsibility) the course covers the 4 managerial steps Planning, Organizing, Leading and Control. There will be a special focus on Project Management.
Teaching methods	
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 - explain the essential factors of good project management (Project

	steps, Project Manager/Project Team/Stakeholders, Tools such as Network Analysis or Gantt Chart, Key Success Factors) - develop and define company goals as a Manager - make decisions as a manager as well as to explain and justify them - recognize the importance of Ethical Behavior in business and develop according management activities - 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
Course contents	- Basics of Management - Decision making in business - Planning - Organizational structure and culture - Change Management - Project Management - Managing Teams - Motivation of employees - Leadership traits and styles - Communication in Business - Controlling - Effective management
Prerequisites	none
Assessment Methods	- Course immanent assessment:Various homework during the online phase – weight 30% - End Exam:Written Exam (2 h) at the end of the course – weight 70%Students must achieve at least 50% in both assessment elements
Recommended Reading and Material	- Stephen P. Robbins, David A. DeCenzo, Mary Coulter Fundamentals of ManagementPearson Education, Prentice Hall ,Auflage, 2012ISBN-10: 0273766171ISBN-13: 978-0273766179(Mandatory Reading)
Attendance	compulsory attendance during on-campus phases
Comments	

Industrial Electronics

Degree programme	BEW

Semester	5
Course methods	FUV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	BEW 5 Industrial Electronics Introduction to:Sensors, Measurement techniques, Power electronics
Teaching methods	Exercises, Own research and report, Discussion in forum, Written examination
Learning outcome	After passing this course successfully students are able to ... - choose appropriate descriptions of measurement results and calculate them - choose suitable approaches for statistical characteristics - point out options for measuring diverse physical quantities and choose the appropriate sensors - Roughly design Buck-, Boost-, and Buck-Boost DC/DC converters
Course contents	- Sensor technologies and sensor types - Properties of measurement instruments - Buck converter, Boost converter, Buck-Boost converter
Prerequisites	Basic knowledge in electro-technics semester 1 to 4
Assessment Methods	- Course immanent assessment method and end exam
Recommended Reading and Material	- Provided within the lecture materials - JCGM: Evaluation of measurement data- Guide to the expression of uncertainty in measurement GUM, 2008. - N. Mohan, T. Undeland, W. Robbins: Power Electronics, Jon Wiley & Sons, Inc.
Attendance	compulsory
Comments	See Moodle lessons

Leadership

Degree programme	BEW
Semester	5
Course methods	FUV
Language	English

ECTS Credits	1.50
Incoming places	Limited

Course description	This course provides an overview of both the latest practical and the current theoretical leadership theories. One of the course's fundamental components will be the student's reflection about particular issues concerning leadership.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - identify and to explain tasks and instruments of leadership (for example delegation, agreement on objectives). - explain classical management models (for example leading continuum, Maturity Model) and to apply to practical examples. - describe different assumptions about human nature (for example McGregor) and to derive the consequences for the leading of co-workers
Course contents	- Leadership styles and instruments (for example staff appraisal) - Motivation, promotion and development of employees - Leadership functions versus professional tasks - Consequence of "not leading" - Role of the leader in a change process
Prerequisites	none
Assessment Methods	- Case study (grade)
Recommended Reading and Material	- Blanchard, Kenneth H./Zigarmi, Patricia/Zigarmi, Drea (2009): Der MinutenManager: Führungsstile, 6. Auflage, Verlag Rowohlt, Reinbek bei Hamburg - Goleman, Daniel/Boyatzis, Richard/McKee, Annie (2012): Emotionale Führung, 7. Auflage, Ullstein Verlag, Berlin - Kasper, Helmut/Mayrhofer, Wolfgang (2009): Personalmanagement, Führung, Organisation, 4. Auflage, Verlag Linde, Wien - Malik, Fredmund (2006): Führen, Leisten, Leben. Wirksames Management für eine neue Zeit, 13. Auflage, Verlag Heyne, München - Wunderer, Rolf (2007): Führung und Zusammenarbeit, 7. Auflage, Verlag Luchterhand, Köln
Attendance	Attendance is compulsary.
Comments	none

Quality Management

Degree programme	BEW
Semester	5
Course methods	FUV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	Understanding the terminology of quality management as well as the sense of such programs, Standards and Certification of management Systems, Quality management tools and methods
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe what Quality in an organisation means - describe how to plan, measure and improve quality - have an understanding of Quality Management and Quality Management Systems - have an overview of tools and techniques used in Quality Management
Course contents	- Development and historical approach of Quality and Quality Management - Defining Quality - Quality for the Customer - Quality Planning, Controlling, Assuring and Delivering - Concepts of Quality - Quality Engineering - Auditing Quality - Statistics for Quality - Total Quality Management: definition, principles - ISO 9000 Standards - CMM and CMMI - Six Sigma - Kaizen - Quality in Project Management - Quality in the future
Prerequisites	none

Assessment Methods	- Group assessments - Individual assessments - Written final examination
Recommended Reading and Material	- quality management DeMYSTiFieD; Author: Sid Kemp, PMP - Actual Version of ISO 9001 (ISO 9001:2015)
Attendance	compulsory attendance during on-campus phases
Comments	

Scientific Practice

Degree programme	BEW
Semester	5
Course methods	FUV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The course consists of:- Exposition of the base elements of working scientifically on foundation of the guide version 2013- Draft of a question catalog for the first advice conversations with the own supervisor of the bachelor work- literature enquiry and correct quotation based on the software program Citavi- first research question and hypothesis formulations due to the bachelor work of one's own- methods and reasoning- time management of the Bachelor scientific processes worked out by Gantt charts
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - draw up the structure of a bachelor work and particularly relevant operative research activities with the help of the 'Guideline for Bachelorpaper and Master Thesis' (version 2013) in the context of a written assignment (LO1). - excerpt the state-of-the-art of scientific literature under mentioning of the central key concepts of the subject area and to maintain into the knowledge database CITAVI in a correct way of quoting (LO2). - work out a first outline based on 'The components of a Bachelorpaper' (Essl, 2015) for the first coaching appointment with their Bachelor supervisors (a) to the structure of the Bachelorpaper in form of a proposal and (b) the project schedule in form of a Gantt

	chart LO3). - verbally account for both the bachelor title and the research questiondiscussed by means of quoted research literature with respect to the current state-of-the-art and developed as a knowledge subject for the respective bachelor work (LO4). - verify causal and circular effect connections in the form of hypothesesand to define in writing with the help of theoretical models (LO5). - make an empirically comprehensible method choice in view of claimed causal connections (based on their hypotheses) and to be more precise under a written mentioning (a) of the respective methodical knowledge possibilities and (b) of the simultaneously effective methodicalknowledge limitations (LO6). - develop an investigation design as a flow chart graphically justified methodologically for their bachelor work and given reasons for their action phases in this (LO7). - assess the data quality of their available data sources using their research issue and (possible) hypotheses (see LE04-05) and using the well-founded method choice (see LE06) knowledge critically and therefore also source critically (LO8). - analyse the discovered results in view of research question(s) and hypotheses in the context of a written assignment theory-orientedly and logically. (LO9).
Course contents	- Presentation of the guide to the constitution of a bachelor work based on version 2013 - What is a science-oriented question? - Why do hypotheses help us according to assertions? - How do I access to empirical data? - How to read scientific literature and empirical sources particularly effectively? - How is right to quote?
Prerequisites	no previous knowledge necessary, therefore working in gradually into the topics of the bachelor work of one's own (as of 4th semester)
Assessment Methods	- Course immanent assessment method: - Assignments 1-6 - Question catalogue for coaching dialogue with the supervisor of the bachelor work and its exploitation protocol after this conversation
Recommended Reading and Material	- Essl, G. (2015), Components of a Bachelorpaper (Checklist for the self assessment). - Günter Essl, Karl Göschka, Susanne Teschl (2013), Guideline for

	Bachelorpaper and Master Thesis. - Skern, T. (2011), Writing scientific English: A workbook, 2nd. ed, Facultas Verlag, Wien.
Attendance	compulsory attendance during on-campus phases
Comments	

Electronic Engineering (BEL)

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	

Microcontroller Software Design

Degree programme	BEL
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	- test, assessment of the submission of individual tasks and projects
Recommended Reading and Material	- 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

International Business Engineering (BIW)

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	

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

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 topics such as automization, digitalization, machines and materials and 3D Printing. 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	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	- Future Trends in Technology (automization, digitalization, machines and materials, 3D printing, AI, and the internet of things.) - Visualizing technical descriptions - Describing technical visualizations - Technical object descriptions - Technical process descriptions - Technical English talk
Prerequisites	B2 level English
Assessment Methods	- 40% Process Description Presentation - 40% Process Description Writing Task - 20% Completion of Self-Study Tasks
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	

Mechanical Engineering (BMB)

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.

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.

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 topics such as automization, digitalization, machines and materials and 3D Printing. 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	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	- Future Trends in Technology (automization, digitalization, machines and materials, 3D printing, AI, and the internet of things.) - Visualizing technical descriptions - Describing technical visualizations - Technical object descriptions - Technical process descriptions - Technical English talk
Prerequisites	B2 level English
Assessment Methods	- 40% Process Description Presentation - 40% Process Description Writing Task - 20% Completion of Self-Study Tasks
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	

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 topics such as automization, digitalization, machines and materials and 3D Printing. 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	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	- Future Trends in Technology (automization, digitalization, machines and materials, 3D printing, AI, and the internet of things.) - Visualizing technical descriptions - Describing technical visualizations - Technical object descriptions - Technical process descriptions - Technical English talk
Prerequisites	B2 level English
Assessment Methods	- 40% Process Description Presentation - 40% Process Description Writing Task - 20% Completion of Self-Study Tasks
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	

Innovation Lab 1

Degree programme	BIF
Semester	3
Course methods	PRJ
Language	English
ECTS Credits	3.00

Incoming places	Limited

Course description	The course is a project course in which technologies and competencies that have been learned in other courses are combined and applied. Project proposals are made available by the degree program. The duration of the projects is between 1 and 3 semesters. By continuing a project through the entire InnoLab series (InnoLab 1 to 3), students have the opportunity to fully implement larger projects.
Teaching methods	project work
Learning outcome	After passing this course successfully students are able to ... - Implement requirements in a team and transform them into an operational IT system - plan and coordinate a project in small groups - work in teams and to coordinate tasks - to present project results in front of colleagues and to argue possible solutions
Course contents	- Practical deepening of the content of other courses in a project
Prerequisites	All courses of previous semesters
Assessment Methods	- Project results
Recommended Reading and Material	- depending on project
Attendance	partly
Comments	The supervision is done on an individual basis in synchronous or asynchronous settings and is supported by modern communication tools.

Innovation Lab 3

Degree programme	BIF
Semester	5
Course methods	PRJ
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	Project Based Learning in Computer Science. The course is intented

	to combine acquired isolated knowledge of various lectures and to put it to practical use. Projects may be proposed by students or can be chosen from suggested projects. Participation in projects at the university or in companies is also possible. The projects need to match the requirements of the current semester (levels and workload). Projects need to have a real customer.
Teaching methods	project work
Learning outcome	After passing this course successfully students are able to ... - Implement requirements in a team and transform them into an operational IT system - plan and coordinate a project in small groups - work in teams and to coordinate tasks - to present project results in front of colleagues and to argue possible solutions
Course contents	- Practical application of the content of other courses in a project
Prerequisites	All courses of previous semesters
Assessment Methods	- Project results
Recommended Reading and Material	- depending on project
Attendance	partly
Comments	The supervision is done on an individual basis in synchronous or asynchronous settings and is supported by modern communication tools.

Mechatronics/Robotics (BMR)

Applied Computer Science

Degree programme	BMR
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

	- Basics of computer architectures - Microcontroller vs. Microprocessor - Introduction to programming with python - Data processing: reading, processing, output of data - Contrul structures and loops - Dictionaries - Funktionen
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	

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 in a small group.
Teaching methods	Integrative lecture, exercises, group 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	

Human Factors and Sports Engineering (BHF)

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 topics such as automization, digitalization, machines and materials and 3D Printing. 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	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	- Future Trends in Technology (automization, digitalization, machines and materials, 3D printing, AI, and the internet of things.) - Visualizing technical descriptions - Describing technical visualizations - Technical object descriptions - Technical process descriptions - Technical English talk
Prerequisites	B2 level English
Assessment Methods	- 40% Process Description Presentation - 40% Process Description Writing Task - 20% Completion of Self-Study Tasks
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	

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	

Current Topics in Life Science Engineering

Degree programme	BHF

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. Their contents are supplemented by current scientific literature in self-study and give students a comprehensive overview of current topics in Life Science Engineering. Groups of students from different study programmes will cooperate during the semester in creating a video explaining selected scientific concepts.
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 from the subject areas of the study program and beyond
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Business Informatics (BWI)

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	

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	

Digital Marketing

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

Course description	After an introduction in classical marketing concepts, the course focuses on digital marketing methods.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - Identify target groups and develop a marketing strategy - describe, plan and implement relevant aspects of digital marketing - distinguish between classical and digital marketing, as well as inbound and outbound marketing - give an overview on digital marketing tools and to use them - describe the customer life cycle and sales funnel, and to derive marketing decisions

	- consider challenges of cross-channel marketing in marketing plans - descfribe and implement growth hacking - implement E-Mail marketing and content marketing
Course contents	- Target groups - 4 P's, 7 P's, 4 C's - Digital Marketing, mobile Marketing - Customer Lifecycle - Growth Hacking - Email Marketing - Content Marketing - Influencer Marketing
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

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	

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 Linux;Knowledge 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	

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	

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	

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	

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	

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	

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	

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	

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 and document

	business processes.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - assess and describe business processes - model business processes (e.g. with EPC) - discuss relevant aspects of organization-wide business process management - develop a business process handbook - apply methods of process assessment and process description - improve processes
Course contents	- Assess and define business processes - Describe relevant aspects of business processes (e.g. inputs, outputs, KPIs, …) - Model business processes - Create process maps - process handbook - business process management handbook
Prerequisites	None
Assessment Methods	- Course immanent assessment
Recommended Reading and Material	- slides
Attendance	mandatory
Comments	

Master DEGREE PROGRAMS

AI Engineering (MAI)

Machine Learning 1: Basics

Degree programme	MAI
Semester	1
Course methods	ILV
Language	German
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	
Comments	

Medical Engineering & eHealth (MME)

Cellular Electrophysiology and Bioimpedance

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	Electric behaviour of cells and tissues under the influence of electromagnetic fields and their possible application in medicine.
Teaching methods	Lecture
Learning outcome	After passing this course successfully students are able to ... - explain the electric behaviour of cells and tissues under the influence of electromagnetic fields - explain applications of electrophysiology and bioimpedance in medicine on examples - point out potentials for innovation using electrophysiology and bioimpedance methodology
Course contents	- Electrolytes - Dielectrics - Electrical properties of molecules & tissues - Instrumentation and measurement, data - Models and some selected applications
Prerequisites	Basics of:- Physics/Chemistry- Electronic- Cellular physiology
Assessment Methods	- written final exam
Recommended Reading	- S. GRIMNES / O.G. Marinsen, Bioimpedance and Bioelectricity

and Material	Basics, Academic Press 2000 ISBN: 0-12-3003260-1 - P.J. RITT et al (eds.) Electrical Bioimpedance methodes: Application to Medicine and Biotechnology, Annals of the N.Y. Academy of Siences, Volume 873, 1999,ISBN: 1-57331-190-1
Attendance	Attendance not required
Comments	

Medical Information Systems

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	The course focuses on IHE Technical Frameworks (Used in ELGA) and touches Continua Healthy Alliance Guidelines for establishing standardized, interoperable and future proof medical information systems.
Teaching methods	Lectures, discussions and group work, self organised work on given topics
Learning outcome	After passing this course successfully students are able to ... - use the basic terminologies of IHE - explain the processes of the IHE Connectathon and the requirements - describe the difference between all XDR, XDM and XDS and their interrelation - describe the IHE Cross-Community Profiles work (based on XCA, XCPD) - describe Identity Management in IHE (based on PIX, PDQ) - describe the basics of IT-Security according IHE Security Profiles (CT, ATNA, XUA, BPPC) - describe the Architecture and Security Requirements of ELGA
Course contents	- IHE/HL7/IEEE/Continua terminologies - General understanding of IHE - Document Exchange Profiles - IT-Security Profiles

	- PHR/EHR Integration - Clinical Document Architecture
Prerequisites	- Basic programming skills- Basic concepts of healthcare
Assessment Methods	- exercises in groups - Final Exam
Recommended Reading and Material	- Teaching materials in the campus system - http://ihe.net/Technical_Frameworks/ - https://www.pchalliance.org/ - http://elga.gv.at/ - Moodle Links
Attendance	Attendance is compulsory
Comments	

Microprocessor Applications in Medicine

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	4.00
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	Lecture slidesPractical exercisesProgramming tasksProject works
Learning outcome	After passing this course successfully students are able to ... - utilize peripheral units like GPIO, UART and ADC - implement microcontroller firmware using C/C++ programming (HW-abstraction, Arduino IDE) - explain SW- and HW-components of microcontroller-based medical devices (e.g. clinical thermometer, blood pressure monitor, blood glucose meter, EEG)
Course contents	- AVR microcontrollers, peripheral units (GPIO, ADC, UART),

	Interrupts - programming using Arduino IDE - Embedded biomedical devices, sensors and actuators
Prerequisites	programming- and electronics basics
Assessment Methods	- Immanent performance evaluation
Recommended Reading and Material	- Jack Purdum: Beginning C for Arduino, 2015, Apress, ISBN:978-1-4842-0940-0
Attendance	Attendance is compulsory
Comments	

Modelling in Cardiovascular Systems

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	This course provides basic knowledge of cardiovascular system dynamics, in particular focusing on the numerical modeling of cardiac pathophysiology and mechanical circulatory assistance.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - explain the basics of cardiovascular system dynamics - explain the basics of modeling of dynamical systems using analogies - solve (numerically) differential equations that model cardiovascular systems using Simulink - autonomously build numerical models of the cardiovascular system
Course contents	- Selection from: - Introduction to blood flow hydrodynamics - Introduction to cardiac and vascular biomechanics - Introduction into compartmental models modeling through analogies - Modeling of cardiac mechanics - Modeling of vascular mechanics

	- Modeling of lung mechanics - Modeling of ventricular assist devices and cardiovascular interaction
Prerequisites	- Basic knowledge of Matlab and Simulink- Basic understanding of first and second order linear ordinary differential equations- Basics of cardiovascular anatomy and physiology
Assessment Methods	- Intermediate assignments requiring a written report of the student work - Final written exam
Recommended Reading and Material	- BOOKS (comprehensive references marked with *): - Guyton AC, Hall JE. (2006) Textbook of medical physiology. 11th ed. Elsevier Saunders. * - Milnor WR. (1989) Hemodynamics. 2nd ed. Williams & Wilkins. - Nichols WW, O'Rourke MF. (2005) McDonald's blood flow in arteries. 5th ed. Hodder Arnold. - Sagawa K, Maughan L, Suga H, Sunagawa K. (1988) Cardiac Contraction and the Pressure-Volume Relationship. Oxford Univ. Press. - Scherf HE. Modellbildung und Simulation dynamischer Systeme (2007). 3. Auflage. Oldenburg Verlag. * - Werner J (2014) Biomedizinische Techink - Automatisierte Therapiesysteme. Band 9. De Gruyter. * - West JB. (2008) Respiratory physiology: the essentials. 8th ed. Lippincott Williams & Wilkins. - Zipes DP, Libby P, Bonow R, Braunwald E. (2004) Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. 7th ed. Saunders.PAPERS: - Carabello BA. Evolution of the study of left ventricular function: Everything old is new again. 2002 Circulation 105(23):2701-3. - Westerhof N, Lankhaar JW, Westerhof BE. The arterial Windkessel. Med Biol Eng Comput. 2009;47(2):131-41.ONLINE DOCUMENTS (very informative about the key concepts of cardiovascular dynamics): - Burkhoff D. 2002. Mechanical Properties Of The Heart And Its Interaction With The Vascular System. Columbia University, NY (www.columbia.edu/itc/hs/medical/heartsim/review.pdf) - Mark RG. 2004. CARDIOVASCULAR MECHANICS I, II, III. MASSACHUSETTS INSTITUTE OF TECHNOLOGY (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-542j-quantitative-physiology-organ-transport-systems-spring-2004/readings/cardio_mech.pdf)

Attendance	Attendance is compulsory
Comments	

EU-Law

Degree programme	MME
Semester	1
Course methods	VO
Language	English
ECTS Credits	1.00
Incoming places	Limited

Course description	In this lecture the students will get an overview of the structure of the EU and its institutions. They will learn how to independently solve cases that are submitted to the ECJ.
Teaching methods	The lecture includes the presentation and plenty of opportunity for discussion.
Learning outcome	After passing this course successfully students are able to ... - solving cases on their own so that they know how to solve legal problems in their jobs.
Course contents	- EU institutions, types of lawsuits, legal bases, structure of laws
Prerequisites	No previous knowledge is necessary.
Assessment Methods	
Recommended Reading and Material	- It is necessary to have worked through my script, which is available in moodle, for the exam.
Attendance	Attendance is necessary because the script and the presentation (ppt) do not contain a solution to the cases.
Comments	none

Corporate Management in Life Science Technologies

Degree programme	MME
Semester	1
Course methods	ILV
Language	English

ECTS Credits	3.00
Incoming places	Limited

Course description	Students will get a broad overview of corporate management
Teaching methods	Lecture: Discussion and examplesSeminar: Seminar paper, discussion and examplesWebinar, video calls
Learning outcome	After passing this course successfully students are able to ... - Students: •are able to analyse financial reports of companies according to managerial standards. •are familiar with common financial ratios and their interpretation. •can determine the cost of capital and the capital structure of a company •can calculate the value of a company •know how to apply risk management tools
Course contents	- •Value oriented management oCapital budgeting (NPV, IRR, etc.) oFinancial ratios oFinancial ratio systems (DuPont, BSC) oValue oriented ratios (EVA, CVA, MVA) oInterpretation of financial ratios •Weighted Average Cost of Capital (WACC) •Company valuation •Capital structure decisions •Business Modeling oIntroduction to forecasting oStatistical methods oScenario analysis •Risk management
Prerequisites	none
Assessment Methods	- Seminar paper (30%), written exam (70%)
Recommended Reading and Material	- •Dr. Karl Knezourek, Slides for the lecture, 2022 •Graham Friend, Stefan Zehle, Guide to Business Planning, The Economist Newspaper Ltd., latest edition (Ch. 14 and 17) •Eugene F. Brigham, Michael C. Erhardt, Financial Management – Theory and Practice, latest edition •Pablo Fernandez, Company Valuation Methods, 2004
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	

Applications for Crowdsourced Healthcare

Degree programme	MME
Semester	1

Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	This course gives a practical introduction into IHE Technical Frameworks (TF). We will start by examining the IHE landscape of technical frameworks (Focused on IT-Infrastructure TF). Tools are presented and applied, which are needed in order to fulfill requirements defined by the different IHE profiles. The single assignments will sum up to a project showing a real-world implementation of communicating/storing/accessing medical information in the growing field of eHealth.
Teaching methods	Project work (in groups)Short-Inputs (lecturer)
Learning outcome	After passing this course successfully students are able to ... - plan and implement a basic Client – Server Architecture - analyse and implement IHE PCD Profile and the use of HL7 v2 - analyse and implement IHE XDS Document Source - establish and integrate and CDA document within an XDS Environment - develop an ATNA client to send audit messages to an open source ATNA
Course contents	- Continua Health Alliance Architecture for including medical device data in Electronic Health RecordsStandards/Basic Technologies: - HL7 v2, v3 (CDA) - Web Services: Http, Soap, WSDL - XML: XSD, XML-Parser, O/X - Mapper
Prerequisites	Fundamentals and Understanding of object-oriented programming (e.g. Java and Eclipse/Netbeans/IntelliJ)
Assessment Methods	- Continuous assessment - Project presentations and project report
Recommended Reading and Material	- Teaching materials in the campus system - IHE ITI-Technical Frameworks Vol 1-4 - IHE DEC-Technical Frameworks Vol 1-2 - HL7 FHIR Specification (online) - Moodle links
Attendance	Attendance to assignment deadlines is mandatory, otherwise no attendance is required.

Comments	

Team Management Skills

Degree programme	MME
Semester	1
Course methods	SE
Language	English
ECTS Credits	1.00
Incoming places	Limited

Course description	In the course the students get to know main principles of leading teams.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - explain the role of leadership in the different stages of team development (for example by Tuckman) and to derive relevant leading actions (for example directive leadership in the forming phase). - diagnose dynamics in project teams using models (for example Rank Dynamics, Drama Triangle, TZI) and to develop and argue case-related concrete opportunities for activities (for example delegation of responsibilty, critical discussion).
Course contents	- Leadership functions and tasks - Leadership tools in project teams - Role conflicts "colleague" and "project leader" - Leading without formal power and competence - Overview of theories to group dynamics - Conflicts and difficult situations in leading project teams
Prerequisites	none
Assessment Methods	- Reflection paper (grade)
Recommended Reading and Material	- Berkun, S. (2005): The Art of Project Management, Sebastopol: O'Reilly Media - Cronenbroeck, W. (2008): Projektmanagement, Berlin: Cornelsen Verlag [bilingual book: in English and German] - Haeske, U. (2008): Teamentwicklung, Berlin: Cornelsen Verlag, [bilingual book: in English and German]

Attendance	Attendance is compulsary.
Comments	none

Workflows in Medicine

Degree programme	MME
Semester	1
Course methods	SE
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	The course provides an overview on workflows in healthcare systems especially at healthcare providers. It introduces typical examples of workflows with an emphasis on distributed and shared workflows.
Teaching methods	Lectures, visits to labs and healthcare provider sites, self guided research
Learning outcome	After passing this course successfully students are able to ... - describe workflows in healthcare as requirements from a technical point of view - evaluate existing and design new workflows using relevant literature (e.g. standards, clinical guidelines, research publications, product documentation) - consider views of different stakeholders (doctors, care persons, other care providers, patients, administration, ...) in projects
Course contents	- Discussion of example workflows (Admission and discharge between GPs, resident care organisations and hospitals, radiology and laboratory workflows, use and maintenance of medical devices, clinical paths, …) - elements ad methods for documenting workflows (goals, results, contributions, roles, use cases, …) - impressions from healthcare environments by e.g. lab and site visits
Prerequisites	none
Assessment Methods	- Workflow seminar paper
Recommended Reading and Material	- 2013 ACCF/AHA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology Foundation/American

	Heart Association Task Force on Practice Guidelines. Clyde W. Yancy, Mariell Jessup, Biykem Bozkurt, Javed Butler, Donald E. Casey, Jr, Mark H. Drazner, Gregg C. Fonarow, Stephen A. Geraci, Tamara Horwich, James L. Januzzi, Maryl R. Johnson, Edward K. Kasper, Wayne C. Levy, Frederick A. Masoudi, Patrick E. McBride, John J.V. McMurray, Judith E. Mitchell, Pamela N. Peterson, Barbara Riegel, Flora Sam, Lynne W. Stevenson, W.H. Wilson Tang, Emily J. Tsai and Bruce L. Wilkoff. Circulation, 2013;128:e240-e327; originally published online June 5, 2013 - doi: 10.1161/CIR.0b013e31829e8776, online (24.10.2014) http://circ.ahajournals.org/content/128/16/e240 - Connor, M. J. & Connor, M. J. Missing elements revisited: information engineering for managing quality of care for patients with diabetes. J Diabetes Sci Technol, iAbetics Inc., Menlo Park, California, USA., 2010, 4, 1276-1283 - Shepherd, M.; Painter, F. R.; Dyro, J. F. & Baretich, M. F.: Identification of human errors during device-related accident investigations.IEEE_M_EMB, 23, 2004, 66-72. - IHE Laboratory Technical Framework, Volume 1 (www.ihe.net). - IHE Radiology Technical Framework Volume 1 (www.ihe.net). - see course materials
Attendance	In order to provide useful group sizes students are required to register for specific on site visits. If registered, students have to attend. Otherwise attendance is optional.
Comments	

Engineering for Therapy & Rehabilitation

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	The course provides knowledge of different rehabilitation issues in different areas of application.
Teaching methods	Lectures and group discussions, Laboratory Course Rehabilitation

	Engineering, Workshops
Learning outcome	After passing this course successfully students are able to ... - define rehabilitation - describe the roles of the different members of rehabilitation teams and the processes within the teams - explain rehabilitation within different medical fields - describe active and passive methods of rehabilitation and physical medicine - describe the role of biomedical engineers within rehabilitation teams - know the basics of prostethics and orthotics.
Course contents	- Physical Medicine - Rehabilitation - Rehabilitation team - Telerehabilitation - Biofeedback - Orthopedics - Prosthetics - Orthotics - Gait Analysis - Reha@home
Prerequisites	- Physiology- Anatomy
Assessment Methods	- Multiple Choice Moodle Exam, presentation
Recommended Reading and Material	- See course material in moodle
Attendance	see requirements of the study program80% mandatory
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	

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	

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	

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	- Function of the lung - 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 - Final exam
Recommended Reading and Material	- Teaching material in the moodle course
Attendance	Attendance is compulsory
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	

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 and Material	- Slide sets of the lecturers
Attendance	Attendance is compulsory
Comments	

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.

Embedded Systems (MES)

Societal Impact Studies

Degree programme	MES
Semester	1
Course methods	SE, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	We aim at assessing problem areas in a society which increasingly depends on electronic communication systems.
Teaching methods	ILV-SE
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; - analyze 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 aviation 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	- Listening, reading and speaking skills at level C1 of the Common European Framework of Reference for Languages.- Knowledge and skills necessary to write short scientific papers in English.
Assessment Methods	- Course immanent assessment method
Recommended Reading and Material	- Recommendations: - I. Asimov (1983): The Complete Robot, Harper Collins - J. C. Augusto, Hg. (2012): Handbook of Ambient Assisted Living: Technology for Healthcare, Rehabilitation and Well-Being, Ios Press - M. Rausand (2014): Reliability of Safety-CriticalSystems: Theory and Applications, John Wiley & Sons Learning materials: - Dedicated scripts and lecture notes - O. Maderdonner et al. (2014): Privacy, Skriptum
Attendance	Attendance is compulsory
Comments	

Sports Technology (MST)

Applied biomechanics and biomechanical multi-body simulation

Degree programme	MST
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	After an introduction to the basics of mechanics and biomechanics, the theorie of biomechanics is prepared and in addition biomechanical multibody-simulatoin software is used. The biomechanics of different sports is developed using hands-on examples.
Teaching methods	ILV
Learning outcome	After passing this course successfully students are able to… name and discuss inner and outer forces acting on athletes during sports, calculate inner forces resulting from outer forces acting on athletes, quasi-statically calculate the center of gravity during exercise based on different anthropometric models, name advantages and disadvantages of biomechanical multibody-simulation software and discuss their sensible use depending on specific research questions, develop simple models based on anthropomtric data using multibody-simulation software, conduct biomechanical analyses using multibody-simulation software describe phases, ground reaction forces and center of pressure for different running styles, describe the most important elements of the mechanics and biomechanics of cycling and to calculate pedal-forces
Course contents	calculation of Center of Gravity anthrompometric models basic biomechanics of different movements and sports inner and outer forces torque inertia

	work power impulse current biomechanical multibody-simulation software (e.g. AnyBody, OpenSim…) calculation of muscle forces calculation of joint forces
Prerequisites	Basic mechanics
Assessment Methods	Exam Different exercises
Recommendation Reading and Material	Klein, P., Sommerfeld, P., 2004, Biomechanik der menschlichen Gelenke, Urban & Fischer Richard, A.A., Kullmer, G., 2013, Biomechanik: Grundlagen und Anwendungen auf den menschlichen Bewegungsapparat, Springer Vieweg Winter, D.A., 2005, Biomechanics and motor control of human movement, Hoboken Bartlett, R., Introduction to Sports Biomechanics Analysing Human Movement Patterns, Second Edition, Routledge AnyBody Tutorials, https://anyscript.org/tutorials Open Sim Tutorials, https://simtk-confluence.stanford.edu/display/OpenSim/Examples+and+Tutorials recent scientific literature
Attendance	cf. Statute on Studies Act Provisions / Examination Regulations
Comments	
Degree programme	MST
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Materials sciences in sports

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 fundamentals of materials testing as well as the structure and properties of materials (metals and polymers). Building on the basics, the understanding of materials is deepened. The lecture is divided into two parts. Part 1 Basics Materials testing, polymers, metals (steel, Al, Mg, Ti) Part 2 Depression Strengthening mechanisms for metals, creep of plastics and metals, nanocrystalline materials, rheology, wood Teaching Methods.
Teaching methods	Presentation with PowerPoint slides
Learning outcome	After passing this course successfully students are able to… select and develop appropriate test methods for materials and sports equipment. select suitable materials for sports equipment. use strengthening mechanisms in metals for applications. to assess new developments in the field of materials.
Course contents	Materials testing and special test methods Polymers Steel Light metals (Al, Mg, Ti) Strengthening mechanisms for metals Creep of metals and plastics Nanocrystalline Materials Rheology Wood.
Prerequisites	none
Assessment Methods	Two partial tests: Part 1 multiple choice + free text, Part 2 written, free text
Recommendation Reading and Material	Seidel, W., 2001, Werkstofftechnik, Hanser Verlag Ehrenstein, G. , 2011, Polymer-Werkstoffe: Struktur - Eigenschaften - Anwendung, Hanser Verlag Rösler, J., Harders, H., Bäker, M., 2012, Mechanisches Verhalten der Werkstoffe, Springer Vieweg (eBook) Weißbach, W., Werkstoffkunde: Strukturen, Eigenschaften, Prüfung,

	Springer Vieweg Verlag (eBook)
Attendance	Two partial tests: Part 1 multiple choice + free text, Part 2 written, free text
Comments	
Degree programme	MST
Semester	1
Course methods	VO
Language	English
ECTS Credits	5.00
Incoming places	Limited

Sports wear

Degree programme	MST
Semester	3
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	5
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
Recommendation Reading and Material	slides will be shared
Attendance	Two partial tests: Part 1 multiple choice + free text, Part 2 written, free text
Comments	
Degree programme	MST
Semester	3
Course methods	VO
Language	English
ECTS Credits	4.00
Incoming places	Limited

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	

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 each student - going through all the steps of the designprocess.
Teaching methods	Projectwork. Introduction designhistory. Introduction Rendersoftware.
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
Course contents	- Complete workflow of a designproject done by each student
Prerequisites	CAD software
Assessment Methods	- Intermediate and final presentation
Recommended Reading	

and Material	
Attendance	Mandatory
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.
Course contents	- hydrostatics - hydrodynamical basics - motions along stream filaments and streamlines - viscous flows - flows with and without vorticity - compressible flows - inviscid flows
Prerequisites	- Foundations of technical, natural, and applied sciences-Mathematical foundations
Assessment Methods	- Final 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	Optional, but especially recommended for the PC lab hoursand also because of the written assignment and group workwhich are assigned during term.
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	

Healthcare and Rehabilitation Technology (MGR)

Wahlfach - Introduction to MATLAB for Applications in Life Sciences

Degree programme	MGR
Semester	1
Course methods	SO
Language	English
ECTS Credits	1.50
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	

Tissue Engineering and Regenerative Medicine (MTE)

Tissue Engineering for Regenerative Medicine

Degree programme	MTE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited

Course description	In the first part of the course the most important tools used in tissue engineering (e.g. cells, scaffolds, cell-cell communication,…) are discussed. After an intermediate exam, the second part of the course at the one hand deals with tissue engineering concepts and strategies of different tissue types (e.g. cartilage, bone,…), on the other hand with the application of cells in regenerative medicine. Course contents are deepened by activities of the students during the course.
Teaching methods	- Lectures- Distance learning- Team work and presentations of the students- Guest lectures
Learning outcome	After passing this course successfully students are able to ... - name different cell types, explain their characteristics and select them for different applications in tissue engineering - list different methods for scaffold production and explain their

	advantages and disadvantages for application in tissue engineering - describe different methods for cell differentiation and select suitable detection methods for cell differentiation - describe the correlation between different tissue components (cells, extracellular matrix,…) and define differences between selected tissue types - describe and compare different tissue engineering concepts using examples - give an overview about the application of cells for regenerative medicine, name examples and explain advantages and disadvantages of stem cells as therapeutics - 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	- Components used in tissue engineering - Primary cells, cell lines and immortalization of cells - Extracellular matrix - Communication between cells - First steps of animal development - Cell differentiation and stem cells - Scaffolds for tissue engineering - Tissue engineering of bones and cartilage - Skin tissue engineering and application - Heart valves tissue engineering - Cell therapy in regenerative medicine - Immunomodulation of mesenchymal stem cell - Biofabrication
Prerequisites	- basic knowledge in cell biology- basic knowledge in biochemistry
Assessment Methods	- Collaboration during lessons - Distance learning - Presentations - Intermediate written exam - Final written 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 literature (e.g. papers) will be provided
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	

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	

Protein Chemistry

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

Course description	Students gain knowledge about the structure and function as well as the analytics of proteins.
Teaching methods	Web-based trainings, lectures, group work and discussions
Learning outcome	After passing this course successfully students are able to ... - explain the structure and chemistry of proteins and name modifications and their functions

	- name the most important methods for the chemical analysis of proteins and explain their principles - explain the function of proteins in detail - explain interactions of proteins with other biomolecules using examples
Course contents	- Repetition of the basics of protein chemistry by means of web-based trainings (amino acids, protein structure, protein modifications, protein quantification, chromatography, electrophoresis) - Antibody engineering - Mass spectrometry of proteins - Recombinant proteins for medical use - Expression Systems - Structure determination of proteins - Protein Folding Stability and Dynamics - Nuclear Magnetic Resonance Spectroscopy (NMR) - Clinical examples of diseases due to protein misfolding - Online excercise - protein folding
Prerequisites	Basic knowledge of protein chemistry
Assessment Methods	- Completion of the Moodle tests for the web-based trainings (>70% correct answers): 20 points - Moodle final test in attendance at the UAS: 80 points
Recommended Reading and Material	
Attendance	Attendance is compulsory in this course (25% absences are tolerated).If you are absent more than 25%, you will lose your first exam entry.
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	

Power Electronics (MLE)

Presentation Techniques

Degree programme	MLE
Semester	1
Course methods	SE
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	Seminar on the basics of presentations, with practical exercises
Teaching methods	Discussing tips for presentationsPreparing and giving a presentationDiscussing and evaluating the presentation by the lecturer and the group
Learning outcome	After passing this course successfully students are able to ... - ....give presentations in English
Course contents	- language of presentations, presentation methods
Prerequisites	Passing the courses of the previous semester
Assessment Methods	
Recommended Reading and Material	
Attendance	Obligatory attendance
Comments	

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	

Information Systems Management (MWI)

Artificial Intelligence in Enterprises (Spezialisierung)

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

Course description	Extended AI chapters with focus on corporate application
Teaching methods	Presentations,Group workindividual assignmentsassessment of solutions
Learning outcome	After passing this course successfully students are able to ...

	- conquer new fields of AI applications depending on company demands - develop solutions individually as well as in groups - estimate efforts and time to implement productive solutions
Course contents	- Neural networks - Recommender Systems - Making decisions - Text analysis - Objekt identification - Simulations
Prerequisites	basic statistics (DATE)introduction to machine learning (MACH)Python
Assessment Methods	- Assignments - Course contributions
Recommended Reading and Material	- will be provided in Moodle
Attendance	Online
Comments	

Systems Engineering

Degree programme	MWI
Semester	1
Course methods	ILV, FL
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 and weekly home works 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 specifications; - recognize the distinguished tests for each development stage of the systems life cycle; - understand the risk management and cost estimation in systems engineering;
Course contents	- Introduction to Systems Engineering - Systems Engineering Viewpoint, Complex systems - Systems Engineering Life cycle - The Systems Engineering method, Stakeholders - Concept development stage of the SE life cycle model - Decision making and Trade-off analysis - Risk management, and Cost Estimation - Systems Modelling with UML - main concepts and overview - Selected aspects of other SE life cycle phases: Testing, Maintenance
Prerequisites	Software Engineering
Assessment Methods	- home work, team project and final exam
Recommended Reading and Material	- Course slides - Textbook: 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

Knowledge and Document Management

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 and end exam
Recommended Reading	- see Moodle

and Material	
Attendance	
Comments	

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	

Big Data & Machine Learning (Spezialisierung)

Degree programme	MWI
Semester	3
Course methods	ILV, FL
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The analysis of large amounts of data is becoming increasingly important for todays' organizations.Gaining insight from data is the core business of many organizations, global enterprises like Google or Facebook as well as small tech start-ups. But companies with other business models are increasingly able to generate competitive advances through intelligent use of their data as well. On the other hand, a company like Zalando is often primarily seen as an online clothing business, while Zalando sees itself mainly as a big data-company. There exists a dynamic landscape of free and open source tools and frameworks for data analysis. The goal of this course is to generate anunderstanding of the main big data topics and an overview of different available tools andframeworks, as well as practical knowledge regarding the steps that are necessary to gain insightfrom raw data. The course further intends to build a tool-agnostic understanding of the underlyingconcepts to be able to keep up with future developments. The following topics will be dealt with bythis course:- Exploratory data analysis- Data visualization and -sonification- Application of unsupervised and supervised machine learning methods- Communication of analysis results- Implementation of a use case in an analytics platform
Teaching methods	- Lecture- Practical group work (on-site and distance)- Group discussions- Group presentations
Learning outcome	After passing this course successfully students are able to ... - distinguish between Data Science and Business Intelligence

	- do an implementation of reproducible data analysis-pipelines - apply methods of exploratory data analysis, both as summary statistics as well as graphical (and auditory) analysis - understand and identify application areas of unsupervised and supervised machine learning methods - discover and identify structural patterns in a data set with unsupervised machine learning tools - create prediction models using supervised machine learning-tools and evaluate their quality - visualize analysis results in an interactive dashboard - create a use case prototype using an analysis platform or python
Course contents	- Exploratory data analysis - Data visualization and –sonification - Application of unsupervised and supervised machine learning methods - Communication of analysis results - Implementation of a use case in an analytics platform
Prerequisites	None
Assessment Methods	- Exam - Practical group project - Peer-Feedback
Recommended Reading and Material	- Data science & big data analytics : discovering, analyzing, visualizing and presenting data; EMC Corporation Indianapolis, Ind. [u.a.] : Wiley 2015 - Analytics in a Big Data World: The Essential Guide to Data Science and its Applications; Bart Baesens; Wiley 2014
Attendance	Yes
Comments	

IT Operations Management

Degree programme	MWI
Semester	3
Course methods	ILV, FL
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course offers an introduction of operational management of IT Organizations and running operation. Based on theoretical aspects and practical use cases.
Teaching methods	Case Studies related to practice, real world examples, group exercises
Learning outcome	After passing this course successfully students are able to ... - Students learn to name and classify the relevant aspects of operations management construct solutions for the relevant areas of operations management derive and assess the consequences of the developed solutions in advance - construct solutions for the relevant areas of operations management - derive and assess the consequences of the developed of solutions in advance
Course contents	- The IT Operations Framework Expectations of Enduser & increasing Complexity - Expectations of Enduser & increasing Complexity - Organizing and construction of your own IT Operation - Organizational View of co-dependent roles for delivering services and maintaining SLA's - Outsourcing – Risks & Chances - Link to ITIL & ISO 27000 in Operations - Plan-Build-Run or the new IT Operating Model aligning to agile Business Needs in a digital World - Operations Management and Cloud Computing - Contract Management & Licensing Models - Influence of EU-DSGVO / GDPR
Prerequisites	Courses from the previous semesters
Assessment Methods	- Course immanent assessment method and final exam
Recommended Reading and Material	- Look at moodle
Attendance	Required – despite of being an online seminar
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	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	
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - name and explain tasks and instruments of leadership (e.g. delegation, target agreement) and explain leadership models (e.g. leadership continuum, maturity model) and apply them to specific cases; - describe agile leadership (e.g. in expert organizations, transformation processes) and apply it by way of example.

	- explain the understanding of digital leadership (e.g. coaching culture) and apply it to specific cases; - apply the systemic loop (from the leadership position) in a theory-based manner in interdisciplinary or intercultural teams.
Course contents	- Fundamentals of leadership - Systems theory in social systems - Leadership in the digital context - Agile leadership - Transformational leadership - Interdisciplinarity and interculturality - Specifics of leadership of expert teams
Prerequisites	
Assessment Methods	Workshops Input & Action, 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	
Comments	

Data Science (MDS)

Scripting

Degree programme	MDS
Semester	1
Course methods	ILV, FL
Language	English

ECTS Credits	5.00
Incoming places	Limited

Course description	The course is about understanding R and Python as a full programming languages and deepening the programming skills in R and Python. This allows for a usage that goes beyond the mere execution of ready-made functions.
Teaching methods	R: Lecture, computer-based lab sessionsPython: Lecture, in-class exercises, remote exercises
Learning outcome	After passing this course successfully students are able to ... - manage data using the available data structures - read, write and display data (console and files) - use elements of structured programming (loops, conditions) - write their own functions - integrate and use libraries - apply the respective object-oriented concepts - create graphics - use interfaces to external systems
Course contents	- R: Data structures (vectors, lists, matrices/arrays, data frames; missing values, strings). Structured programming (loops, conditions, vectorization, functionals: apply and friends). Functions. Object-oriented concepts (S3, S4, and others). Graphics (base and grid graphics). Performance and profiling. - Python: Data structures (tuples, lists, dictionnaries, sets, strings). NumPy and Pandas: arrays, aggregation, indexing, data manipulation, handling missing data, combing data sets, pivot tables, time series data, classes, input and output, visualization using matplotlib and plotly
Prerequisites	Basic (also object-oriented) programming skills
Assessment Methods	- In-class exercises, final exams
Recommended Reading and Material	- Wickham, 2019: Advanced R. CRC Press. - Lutz, 2015. Learning Python. O'Reilly - McKinney, 2017. Python for Data Analysis, O'Reilly
Attendance	Attendance is mandatory
Comments	

Data Warehouse & BI

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

Course description	This course introduces key concepts, technologies and methods of Data Warehousing and Business Intelligence. Amongst others, an overview of Analytics and Data Warehousing is given (modeling and implementation of a data warehouse). Moreover, the management of BI-related projects as well as basic techniques for data modeling and presentation and selected aspects of data management are addressed in this course. Finally and with respect to practical skills, students learn how to set up an ETL process to populate a data warehouse. An OLAP cube will be created, which will be analyzed in a BI application.
Teaching methods	- Lectures- Interactive Tutorials- Practical group work (on-site and distance)- Group presentations
Learning outcome	After passing this course successfully students are able to ... - give an overview of Business Intelligence and Data Warehousing and develop a BI-related business case and plan a project on a micro-level accordingly - elicit requirements for a BI solution with respect to a business context - create a data model for a BI solution and prepare the data set - handle data sources, asses data quality and retrieve data from database systems - explain fundamental BI operations, select appropriate BI tools and apply them to real-life data - implement a multidimensional analysis model (OLAP) and analyze the data - carry out a complete DWH project (planning, implementation, reports) using data from an ERP system
Course contents	- Introduction to Business Intelligence (BI) and Data Warehousing (DW) - Development of business cases and BI projects - Business Architecture and Requirements

	- Data Modeling for DWHs (Dimensional Fact Modeling, Galaxy Schema) - Data management (data sources, data quality and databases) - Extract-Transform-Load-process - BI operations, tools and methods - Data representation (scorecards, dashboards)
Prerequisites	Knowledge on data modeling, databases, project management and statistical methods
Assessment Methods	- Course immanent assessment method and end exam
Recommended Reading and Material	- Haertzen, D., 2012. The Analytical Puzzle: Profitable Data Warehousing, Business Intelligence and Analytics. 1. Ausgabe. Technics Publications. - Kimball, R., Ross, M., 2013. The Datawarehouse Toolkit (2nd Ed., Chapters 1-6)
Attendance	Required
Comments	

IT-Security (MCS)

Intercultural Communication

Degree programme	MCS
Semester	1
Course methods	SE
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	In the 21st century, with globalisation having become a reality above all in science, technology and business, it is crucial that our graduates have a solid understanding of intercultural communication.
Teaching methods	Interactive, multi-channel, real-life-based presentations and discussions, with an emphasis on student participation.
Learning outcome	After passing this course successfully students are able to ... - function successfully in an intercultural, international business environment - explain key intercultural theories

	- the ability to adapt their own cultural behaviour - appreciate the link between culture and ethics and its impact
Course contents	- Lecture modules on intercultural theory and key differences between cultures - Presentations of real-life examples - Exercises & discussions
Prerequisites	Completion of previous semester courses
Assessment Methods	- Class participation (including quizzes & discussions) - Presentations
Recommended Reading and Material	- Trompenaars, F., and Hampden-Turner C., (2012) Riding the Waves of Culture, London: Nicholas Brealey ISBN 1-85788-176-1 (on CIS) - Additional handouts, case studies, and audio-visual support
Attendance	Attendance is compulsory
Comments	For further details please see the semester plan on CIS

Innovation and Technology Management (MTM)

Innovative Information and Communication Technologies

Degree programme	MTM
Semester	1
Course methods	ILV
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	In this lecture students acquire knowledge and develop Competences in the field of information- and communication-technology
Teaching methods	self-study, lecture, Discussion, E-Learning
Learning outcome	After passing this course successfully students are able to ... - to explain the importance of Informationstechnologie for enterprises - to list the potential harms of cyber crime and discuss appropriate countermeasures - to list typical tasks of an IT-departmant in a company

	- to discuss areas of application for new information technologies (eg IoT, Big Data, Blockchain etc.) - to contribute to the development of the digitals strategy of a company
Course contents	- Informationstechnologie n general - enterprise ressource planning - business intelligence - cloud computing - cyber crime - IT-management - E-Commerce - Big Data - Artificial Intelligence - Internet of Things - Virtual Reality - Blockchain - Digital office
Prerequisites	key concepts in IT and electronics
Assessment Methods	- final written exam (80%), projekt work and studies (20 %)
Recommended Reading and Material	- Turban et al, Information Technology for Management
Attendance	There is mandatory attendance in this course.with 60 %
Comments	Further information regarding this course is provided via the accompanying moodle-course.

Innovation Management

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 develop competences in the field of Innovation Management.
Teaching methods	self-study, lecture, discussion, group work, case studies, mutlimedia

	presentations, short online tests, final exam
Learning outcome	After passing this course successfully students are able to ... - distinguish between different forms of innovation - know about different innovation strategies - to establish an innovation-friendly corporate culture - to apply various project selection methods - to know about a systematic innovation process from idea finding to market entry
Course contents	- Innovation - Motivation and Relevance of Innovation Management - Sources of Innovation - Open Innovation - Types of Innovation - Innovation Diffusion - Innovation Strategies - Innovation process incl. Stage Gate Process - Management of the NPD process - R&D project selection - Management of teams in the NPD process - Industrial property rights (in particular patents, utility models, designs)
Prerequisites	key concepts in business administration
Assessment Methods	- written test (60% at least half of the points must be achieved in order to pass the course) + teamwork on 'methods of innovation management' (20%) + temwork 'case study' (20%)
Recommended Reading and Material	- Schilling, M. A. (2022). Strategic Management of Technological Innovation. 7th ed., New York: McGraw-Hill Education. [International Edition!] - additional papers will be provided
Attendance	Attending 75% of the synchronous teaching units is compulsory, regardless of whether they are held in presence or online. Attendance of less than 75% will result in the reduction of one possibility of repeating the final exam.
Comments	Further information and material regarding this course are provided via LMS moodle.

Empirical Market Research

Degree programme	MTM

Semester	1
Course methods	ILV
Language	English
ECTS Credits	4.00
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	- written test (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	

Technical Sociology and Technology Assessment

Degree programme	MTM
Semester	3
Course methods	SE
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	In this course, concepts of sociology of technology and technology assessment are introduced, critically discussed and applied to selected areas of practice. Selected areas of practice will be evaluated in detail under the aspects of technology assessments (e.g. societal, economic, ethical, legal aspects). The areas of practice include Smart Care (Care 4.0) and mediatized or eFitness. This course further deals with presentation and discussion of various approaches, methods and intensities of presuming and end-user involvement.
Teaching methods	lecture; webinar; presentations; various discussion formats in small groups and in plenary; group work
Learning outcome	After passing this course successfully students are able to ...

	- critically discuss concepts of sociology of technology and technology assessment - reflect upon areas of practice such as care and fitness in the context of technology assessment - explain models to design and manage user-centered and user-triggered Innovation Processes (e.g. prosuming)
Course contents	- Introduction to theoretical concepts of sociology of technology, and technology assessment - Development and effect of technologies at a macro and a micro level: Tension between technology and society - Discussion of selected areas of practice e.g. eSports / Mediatized Fitness, Smart Care - Key terms and definitions (e.g. end-user, stakeholder, prosumer, participatory design, inclusive design) - Presentation of various approaches and intensities of end-user involvement
Prerequisites	No specific requirements needed.
Assessment Methods	- Discussion paper (80%) + Presentation of discussion paper (20%)
Recommended Reading and Material	- Bauchspies, W., Croissant, J., Restivo, S. (2005): Science, Technology and Society. A sociological approach. Wiley-Blackwell. (selected chapters) - Kaabi-Linke Timo. „Technik im Ausnahmezustand: Wenn Dinge widerspenstig werden.“ In: Zeitschrift für Erziehungswissenschaften, 2013. 16(2). 267-285 - Pavitt, Keith. The process of innovation. Vol. 89. SPRU, 2003. - Friesacher, Heiner. „Pflege und Technik – eine kritische Analyse“. In: Pflege und Gesellschaft, 2010. 15(4). 293 – 313 - Assistive Technologien Ethische Aspekte der Entwicklung und des Einsatzes Assistiver Technologien Stellungnahme der Bioethikkommission beim Bundeskanzleramt (2009). URL: https://www.bka.gv.at/DocView.axd?CobId=39411 - Blättel-Mink; B.; Hellmann, K. U. (Hrsg.) (2010). Prosumer Revisited. Zur Aktualität einer Debatte. VS. (S.13-48). - Neven, L. (2010). ‘But obviously not for me’: robots, laboratories and the defiant identity of elder test users. In: Sociology of Health & Illness, 32 (2), 335–347.
Attendance	80% Attendance
Comments	Literature and further materials for the course will be uploaded on Moodle.

Digital Leadership & New World of Work

Degree programme	MTM
Semester	3
Course methods	UE
Language	English
ECTS Credits	4.00
Incoming places	Limited

Course description	In this course, students acquire knowledge and skills in the areas of leadership (personnel management), organization and work design.
Teaching methods	Self-study, lecture, guest lectures, exercises, discussion, case studies, role plays, teaching excursion.
Learning outcome	After passing this course successfully students are able to ... - outline the most important trends in the labor market as well as in HR management - Weigh the advantages and disadvantages of different leadership theories and concepts. - motivate employees and lead virtual teams in an increasingly digitalized work environment - Weigh the advantages and disadvantages of centralized and decentralized organizational structures. - Use productivity-enhancing work tools (e.g., video conferencing tools, enterprise social network, etc.) - to design digital training measures for life-long learning
Course contents	- Trends in the economy: globalization, digital transformation and Industry 4.0, etc. - Trends in the labor market: demographic change, diversity, changing values, etc. - Trends in HR management (e.g. talent management, age management, diversity management, etc.) - Traditional trait, behavioral and situational theories of leadership - Modern leadership concepts (e.g. transformational leadership, agile leadership, servant leadership, etc.) - Motivation and leadership in increasingly virtual contexts - Democratization of leadership (e.g., decentralization, scrum, holocracy, etc.) - Productivity enhancing tools for the New World of Work (e.g. video conferencing tools etc.)

	- Lean Administration & Paperless Office - Life Long Learning - Competence requirements and transfer in the digitalized world of work
Prerequisites	
Assessment Methods	written test (20%) + case study elaboration (80%)
Recommended Reading and Material	- Franken, Führen in der Arbeitswelt der Zukunft - Petry, Digital Leadership. Erfolgreiches Führen in Zeiten der Digital Economy
Attendance	attendance is compulsory
Comments	

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	**This course is an elective course in the curriculum of MSE, the course opening is depending on the number of applications.**

Mental Power for IT Disciplines

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

Course description	In thus course you will learn to use the whole capacity of your brain to solve problems and to achieve any goal you wish
Teaching methods	Seminar and distant learning
Learning outcome	After passing this course successfully students are able to ... - formulate goals you want to achieve which are suitable for your subconsious mind - practicing basic elements of attention meditation - focus the conscious mind on goals to align unconscious processes
Course contents	- Processing of information in the human brain - Consciousness and unconsciousness parts of the brain - Gaining consciousness use of primarily unconsciousness parts of the brain - Using skill full meditation techniques to improvebusiness performance

Prerequisites	none
Assessment Methods	- Continuous assessment
Recommended Reading and Material	- James Borg, "Mind Power", Pearson 2010 - Kazuo Inamori, "A Compass to Fulfillment", Mc Graw Hill 2010 - Heinz Hilbrecht, "Meditation und Gehirn", Schattauer, 2010 - Richard Bandler, "Veränderung des subjektiven Erlebens", Jungfern Verlag 2007, Original: "Using your brain - for a change", Real People Press, U.S. (August 1985) - Henry P. Stapp, "Mindful Universe" 2nd Edt Springer 2011 - Chade-Meng Tan "Search Inside Yourself" Optimiere dein Leben durch Achtsamkeit, Goldmann Verlag 2015 - David Eagleman, "Incognito: The Secret Lives of the Brain", Canons 2016 - Leonard Mlodinow, "Subliminal: How Your Unconscious Mind Rules Your Behavior", Vintage books 2013
Attendance	Required
Comments	**This course is an elective course in the curriculum of MSE, the course opening is depending on the number of applications.**

Language Concepts

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

Course description	Concepts of Progamming languages, programming paradigms, foundations of compilers and interpreters
Teaching methods	Lecture, exercises, interviews
Learning outcome	After passing this course successfully students are able to ... - design context free grammars and regular expressions - develop a simple compiler for a small language using compiler tools - write programs using logical and functional programming languages
Course contents	- Imperative paradigm: procedural, object oriented - Declarative paradigm: functional, logic

	- Context free grammars, regular expressions - Compiler construction basics and static program analysis - Halting problem, turing machines
Prerequisites	knowledge of a programming language, C advantageous
Assessment Methods	- 60% exercises, 10% participation, 30% final interview
Recommended Reading and Material	- Carlo Ghezzi, Mehdi Jazayeri. Programming Language Concepts. - John C. Mitchell. Concepts in Programming Languages. - Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Compilers: Principles, Techniques, and Tools. - Donald Knuth. The Art of Computer Programming.
Attendance	mandatory
Comments	**This course is an elective course in the curriculum of MSE, the course opening is depending on the number of applications.**

Microservice Architecture

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

Course description	Students will be introduced into the topic of Microservice Architecture. By developing an example system issues regarding design, deployment, testing and operations can be learned by doing.
Teaching methods	During the course it will be switched between practical and theoretical sessions. The development of the example system is organized in smaller projects realized by the students.
Learning outcome	After passing this course successfully students are able to ... - Design and evaluate Microservice Architectures - Create solutions for implementation, operation, and deployment of systems following Microservice Architectures - Knowing of how to assure quality in Microservice Architectures
Course contents	- Design Microservice Architectures (DDD, patterns) - Implementation (Message based systems, database dependencies, frameworks)

	- Deployment and operations of systems build on Microservice Architecture (containerization, monitoring, logging) - Methods of quality assurance in Microservice Systems
Prerequisites	
Assessment Methods	- 30% collaboration during the course - 40% projects - 30% exam
Recommended Reading and Material	
Attendance	compulsory attendance
Comments	**This course is an elective course in the curriculum of MSE, the course opening is depending on the number of applications.**

Master Projekt

Degree programme	MSE
Semester	3
Course methods	PRJ
Language	English
ECTS Credits	21.00
Incoming places	Limited

Course description	The course provides space for preparatory activities for the Master Thesis carried out as a project. The results are incorporated in the Master Thesis.
Teaching methods	Project Based learning (jPBL)
Learning outcome	After passing this course successfully students are able to ... - to complete their master's thesis according to the rules of project management.
Course contents	- Preparatory work for the Master's thesis For example: - Programming activities - Theoretical work - Participation in IT projects - Evaluation of technologies and products with scientific methods - Feasibility study, prototype development
Prerequisites	Courses of the first and second semester of the master software

	development
Assessment Methods	- Assessment of the master’s thesis project
Recommended Reading and Material	- Textbooks, journals and online articles which are relevant for the project.
Attendance	not required
Comments	The master's project is continued in the following semester as master's thesis. Accordingly, the assessment is an interim assessment. A completed project or completed work is not required for grading. The supervision is done on an individual basis in synchronous or asynchronous settings and is supported by modern communication tools. The course is not displayed in the timetable and no attendance records are kept.

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	

Professional Writing Skills

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

Managerial Economics and Operations Research

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

Course description	Operations Research:Game Theory, Markov-Chains & Networks

Teaching methods	Lecture with examples for engrossing.
Learning outcome	After passing this course successfully students are able to ... - apply the analytic elements of game theory with regard to their limitations on practical problems. - model Markov-Chains and depict, describe and simulate practical problems. - draft waiting line models and depict, describe and simulate practical problems. - evaluate various algorithms for the characterizations of networks with regard to their applicability.
Course contents	- The development of game theory, its applications and limitations. - The application of Markov-Chains and waiting line models on typical processes from the fields of manufacturing and logistics. - Description and well-founded selection and application of algorithms to describe and characterize networks.
Prerequisites	Production Management, Linear Programming.
Assessment Methods	- Final written exam
Recommended Reading and Material	- Alba, E.; Nakib, A. & Siarry, P. (2013) “Metaheuristics for Dynamic Optimization” Springer - Brucker, P. & Knust, S. (2012) “Complex Scheduling” Springer - Eiselt, H.A. & Sandblom, C.-L. (2010 & 2012) "Operations Research - A Model-Based Approach" Springer - Fransoo, J.C.; Waefler, T. & Wilson, John R. (2011) “Behavioral Operations in Planning & Scheduling” Springer - Giannoccaro, I (2013) “Behavioral Issues in Operations Management” Springer - Rao, R: Venkata (2013) “Decision Making in Manufacturing Environment Using graph Theory and Fuzzy Multiple Attribute Decision Making Methods” Springer - Saha Ray, S. (2013) “Graph Theory with Algorithms and its Applications” Springer
Attendance	Attendance is compulsory
Comments	

Internet of Things and Smart Systems (MIO)

Innovation- and Technologymanagement

Degree programme	MIO

Semester	1
Course methods	SE
Language	German
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	After passing this course successfully students are able to ... - 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	-

Data Management

Degree programme	MIO
Semester	1
Course methods	LAB
Language	German
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	After passing this course successfully students are able to ... - 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	- Intermediate test (30%) - Final test (70%)
Recommended Reading and Material	
Attendance	
Comments	

Mobile and Wireless Systems

Degree programme	MIO
Semester	1
Course methods	LAB
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description	The scope of this lecture are the basics, necessary for wireless data transmission and communication
Teaching methods	Presentation Excercises | SimulationStudy of provided material and references
Learning outcome	After passing this course successfully students are able to ... - understand the basics of wave propagation - understand the elements a transmission path or circuit - understand the implementation of cellular communication networks, the related procedures like connection Setup, Authentication, Authorization, Handover and the associated signaling between the involved network elements - calculate the coverage and the capacity of the air interface - understand technologies like, digital modulation-, multiple access-, duplex-schemas, antenna technologies, MIMO and the associated mathematical basics in this context - understand the concepts of NFV, SDN, and Network Slicing as applied in 5G - understand the concepts of Low Power Wide Area Networks, their applicability and the aspects necessary to be considered in context of application development - understand the necessity of a standardized software middle layer, in respect of scalability and interoperability in context of application development
Course contents	- Network- architectures and elements as well as the associated protocols as used in (GSM, GPRS, 3G, LTE, 5G..) - Cellular technologies for IoT devices (NB-IoT, LTE Cat-M, Lora) - Procedures and signaling of cellular communication systems - Physical aspects of the Air interface and related technologies for the data transmission over a wireless channel (CDMA, OFDMA, MIMO etc..) - NFV, SDN and Network Slicing - Standardized Software components (oneM2M, LwM2M) to ensure interoperability of applications
Prerequisites	Basic mathematical skills in:x.) Fourier seriesx.) Fourier transformx.) Trigonometric functions
Assessment Methods	- two written exams
Recommended Reading and Material	
Attendance	

Comments	

IoT Operating Systems

Degree programme	MIO
Semester	1
Course methods	LAB
Language	German
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 (STM32), followed by the programming of FreeRTOS based sensor nodes (STM32), ending with Linux as operating system for gateways and servers.
Teaching methods	This course is based on theory (lecture), practical demonstrations and practical exercises.
Learning outcome	After passing this course successfully students are able to ... - explain basic operating system functions, such as the process model and virtual memory management. - 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 (e.g. HDDs, SSDs) 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). - be able to select the appropriate RTOS services, task models, scheduling methods and design patterns for embedded software applications be able to apply 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 tests
Recommended Reading and Material	
Attendance	optional
Comments	

IoT System Models

Degree programme	MIO
Semester	1
Course methods	ILV
Language	German
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	After passing this course successfully students are able to ... - 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	

Networking

Degree programme	MIO
Semester	1
Course methods	LAB
Language	German
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	After passing this course successfully students are able to ... - 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	