UAS Technikum Wien

COURSE GUIDE SS2026

COURSES OFFERED IN ENGLISH

Please note:

Incoming students have the possibility to combine courses from different study programs. The number of places available for Incoming students in each course may vary or be limited to a certain number.

Please be aware, that incoming students are obliged to generate at least 9 ECTS from the Campus International.

At the beginning of each semester an Orientation Week is held for all Incoming students as well as for all Double Degree students.

The Orientation Week takes usually place in the 2nd week of September resp. 2nd week of February.

Please take into consideration that this course guide may be subject to change!

Last update: 17.10.25

OVERVIEW OF COURSES OFFERED ENTIRELY IN ENGLISH

Inhaltsverzeichnis

CAMPUS INTERNATIONAL

Campus International

Empowering Intercultural Teams for Success: Theory - Tactics – Solutions

Degree programme	ECI
Semester	2
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	

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

Degree programme	ECI
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Do you want to study abroad and do you want to get the most out of your time studying abroad? Then this course is for you! Here, we will

	be examining cultural differences and how to work with them as well as ways in which universities and systems of education can differ across countries and how to negotiate these differences. This will be a highly interactive course: I will be presenting key aspects of intercultural theory and you will be presenting study experiences in specific countries and working through case studies together. There will also be many opportunities to improve your communication skills in English as a medium of communication (by learning suitable strategies) and also many opportunities to work with and get to know other international students. The course has been running successfully for one semester and I have lots of ideas to make it even more useful and absorbing in the coming semester!
Teaching methods	Theoretical input, group workshops, teamwork, group discussions, independent research, participant preparation of written documents.
Learning outcome	After passing this course successfully students are able to ... - question their cultural stereotypes and prejudices in the context of Erasmus+; - •reflect on different strategies for dealing successfully with likely cultural differences during their semester abroad; - understand the approaches they can use to prepare for the bureaucratic and technical challenges of their semester abroad; - negotiate a variety of typical challenging situations that they will likely face in an international environment.
Course contents	- Tactics, personal behaviours and qualities to be strengthened for achieving success during the semester abroad; - Bettering intercultural awareness and recognition of stereotyping; - Hofstede's cultural dimensions; - Techniques for efficient communication in English as a Lingua Franca; - Practice in overcoming challenges and problems in an intercultural environment (role plays)
Prerequisites	B2 level English
Assessment Methods	- 50% student presentations - 25% completion of participation tasks - 25% final written task
Recommended Reading and Material	- Script
Attendance	75% mandatory
Comments	

CI_Traffic Safety Culture and Mobility

Degree programme	ECI
Semester	2
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_German Language & Austrian Culture B1

Degree programme	ECI
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This integrated course provides the linguistic skills to deal with most situations likely to arise whilst you are staying in Austria. You will be prepared to enter into conversation on topics that are familiar, of personal interest or pertinent to everyday life (e.g. family, hobbies, work, travel and current events).
Teaching methods	Group work, role plays, text production, excursion, audio- and video

	files, authentic texts
Learning outcome	After passing this course successfully students are able to ... - understand the main points of clear standard speech on familiar matters regularly encountered in work, school, leisure, etc - understand the main point of many radio or TV programmes on current affairs or topics of personal or professional interest when the delivery is relatively slow and clear. - understand texts that consist mainly of high frequency everyday or job-related language. - understand the description of events, feelings and wishes in personal letters.
Course contents	- Topics: Family life, contacts, men and women today, work environment, travelling and traffic, nature and environment - Grammar: Subordinate clauses, adjective+article, infinitive construction, Tenses, reflexive pronouns, subjunctive I +II, passive voice
Prerequisites	German A2 level
Assessment Methods	- Tests (mid-term and final test,) performance in class, homework
Recommended Reading and Material	
Attendance	80%
Comments	

CI_Building Climate Engineering

Degree programme	ECI
Semester	2
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	2
Course methods	ILV
Language	English
ECTS Credits	3.00

Incoming places	Limited
Course description	This integrated course provides students the opportunity to familiarise themselves with the basics of acoustics and audio engineering, including perception of sound, microphones, amplifiers, loudspeakers, audio processing, etc.
Teaching methods	The Lecturer will explain some basic concepts. The students will compete tasks in the computer using Matlab.
Learning outcome	After passing this course successfully students are able to ... - Understand the signal chain in a typical audio application, and be able to recognise and avoid distortions in all stages - understand how humans perceive sound, - record sounds using the appropriate equipment, - measure different attributes of sound and understand how they correlate to human perception, - analyse and interpret recorded sounds - synthesise sounds with specific attributes - perform audio processing on recordings - understand how audio compression works
Course contents	- Sound and sound attributes - Human perception of sound - Signal chain in audio engineering - Microphones and amplifiers - Analog vs digital signals - Fourier Analysis, Spectrum, Spectrogram - Synthesis of sounds - Filters - Audio compression - Lourspeakers09
Prerequisites	Basic programming skills. Matlab knowledge advantageous.
Assessment Methods	- The students will be assessed according to how far they completed the task at hand
Recommended Reading and Material	- Script provided by the lecturer
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_German Language & Austrian Culture A1

Degree programme	ECI
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Basics in German grammar and conversation. The course should prepare you to get along in everyday situations. To get and to give simple personal information, information about your life and your work. Basic grammar:the article tenses, pronouns, word order, question and negation, modal verbstopics: me and the others, people and things, student's life, living,shopping
Teaching methods	group work, role plays, text production, excursion
Learning outcome	After passing this course successfully students are able to ... - master everyday situations in German
Course contents	- Basic Grammar: Verb Konjugation, the article, Nouns in Singular and Plural, Modal Verbs - Topics: Living together, Looking for an apartment, Furniture, clothes, Sights, Arts, Basic information about Austrian culture
Prerequisites	None
Assessment Methods	- mid-term test; Final-Test (written and oral), Attendance, performance in class
Recommended Reading and Material	- 1.)Panorama; Deutsch als Zweitsprache Kursbuch A1.1 ISBN 978-3-06-120472-3; 2.)voluntarily: Übungsbuch A1.1. ISBN 978-3-06-120602-4
Attendance	minimum attendance of 75 % required
Comments	Try to have the book for the first lesson. It is available at "THALIA" bookshops

CI_German Language & Austrian Culture B2

Degree programme	ECI
Semester	2
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	Compulsory
Comments	

CI_Scientific Writing

Degree programme	ECI
Semester	2
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_From Application to Interview

Degree programme	ECI
Semester	2
Course methods	SE
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	This course provides a comprehensive instruction in the essential aspects of applying to organisations for either courses, internships or full time jobs. In addition to coaching students in writing a letter of application, a CV, completing an online application form as well as successfully interviewing, the instructor will also input ideas regarding the creation of a suitable online presence and, also, critical examples of culturally sensitive behaviour for international applications.The course is very interactive and there will be many opportunities for students to practice and receive direct coaching, feedback and advice on their work.
Teaching methods	LectureExercises and group exercisesWriting workshopInterview workshop including practice interviews
Learning outcome	After passing this course successfully students are able to ... - This course provides a comprehensive instruction in the essential aspects of applying to organisations for either courses, internships or full time jobs. In addition to coaching students in writing a letter of application, a CV, completing an online application form as well as successfully interviewing, the instructor will also input ideas regarding the creation of a suitable online presence and, also, critical examples of culturally sensitive behaviour for international

	applications.
Course contents	- The course will be divided into four sessions: Written applications – input Written applications – workshop session and feedback Interviews – input Interviews – workshop, practice input
Prerequisites	N/A
Assessment Methods	- N/A
Recommended Reading and Material	- Material will be provided by the lecturer via moodle
Attendance	mandatory, only 20% absence can be tolerated
Comments	

CI_German Language & Austrian Culture A2

Degree programme	ECI
Semester	2
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 ; Kursbuch A2.1 Cornelsen Verlag ISBN 978-3-06-120488-4(also available as E-Book)/voluntarily: Übungsbuch A2.1 ISBN 978-3-06-120604-8
Attendance	Intermediate TestFinal Test (written and oral)Attendance and performance in Class
Comments	Try to have the book for the first lesson. It is available at "THALIA" bookshops

CI_Renewable Energy Laboratory

Degree programme	ECI
Semester	2
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_Electronic Laboratory

Degree programme	ECI
Semester	2
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	

Service and object-oriented Algorithms in Robotics

Degree programme	ECI
Semester	2
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	The course discusses important concepts regarding robot control in the context of modern data-driven robotics. Thus, different methodologies from robotics and data-science are are taught and applied using Python and the robot operating system (ROS).

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

International Marketing

Degree programme	ECI
Semester	2
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	- Global Marketing, Hollensen, 2016

and Material	- International Marketing, Czinkota , Ronkainen 2012 - Strategic Brand Management, Keller 2013
Attendance	Attendance is compulsory.
Comments	Detailed information regarding the course is provided via Moodle.

Building and Solar Energy

Degree programme	ECI
Semester	2
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

Mobile Robotics

Degree programme	ECI
Semester	2
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	The course provides an introduction to the basics in mobile robotics with regard to essential mobile robot components. Students achieve a basic understanding of methods to control mobile robots by implementing behaviours as well as methods for direct sensor-actor coupling.
Teaching methods	This course is based on theory and practical exercises/projects using simulation of mobile robots. The first classes are supported by a theory lecture (theory, methods, mathematics and algorithms) and guided exercises before students solve project tasks in small groups

	(solving various problems arising in robot control in simulation/on real robots).
Learning outcome	After passing this course successfully students are able to ... - explain basic methods of control theory required for mobile robots, - visualise and interpret a mobile robot's sensor readings using the robot operating system, - control mobile robots by applying behaviour methods for direct sensor-actor coupling, - apply basic programming knowledge in Python to examine and model behaviour of a mobile robot's control system.
Course contents	- Introduction to important concepts in robotics and ROS - Coordinate systems and transformations in robotics - Mobile robot kinematics - Essential control theory
Prerequisites	Mandatory: Sensor technology and basic understanding of programming, in particular in Python or C
Assessment Methods	- 70% Group project with presentation - 30% Exercises
Recommended Reading and Material	- http://wiki.ros.org/ROS/Tutorials - C. M. Bishop, Machine Learning and Pattern Recognition, 2006 - S. Russell and P. Norvig, Artificial intelligence: a modern approach, 1995
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the semester project.
Comments	

Data Ethics and Open Data

Degree programme	ECI
Semester	2
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.

BACHELOR DEGREE PROGRAMS

Renewable Energies

Applied Computer Science

Degree programme	BEE
Semester	4
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 - Collections - Functions - File-Handling - Regular Expressions - Application Bundeling - Raspberry Pi - M2M-communication - Open Data
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

Software Engineering 2 Labor

Degree programme	BIF
Semester	4
Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The course is an introduction to UI development in Java or C# .NET. The main focus is on the separation between the user interface (graphically) and the appropriate code for controlling it. In professional software development environments, it is not sufficient to just write working code. It is important to structure the code in a comprehensible way considering standard patterns and documentation principles. By respecting the concepts of this lecture we improve the overall quality, the readability, traceability, expandability and interchangeability.You can choose between C# and Java for the development process during the full course.
Teaching methods	The theory part consists of self-study phases, Moodle Tests and attendance. The practical part is a course project in which all learned content is applied.
Learning outcome	After passing this course successfully students are able to ... - implement a graphical user interface with the help of WPF or JavaFX - use a logging library to document and track runtime behavior of an application - create simple reports with tables and images using a PDF library - design and implement loosely coupled classes and interfaces - plan the deployment of an application and identify possible critical paths

	- use LINQ or Java Streams to implement functional programming concepts - consider SOLID principles during development of object-oriented software - detect, name and extend design patterns after Erich Gamma in object oriented software - reproduce visual modeling basics that include modeling goals and the concepts of object orientation - model class diagrams to visualize the classes of a software system and their relationships, as well as their behavior and properties - model sequence and communication diagrams to represent communication between classes
Course contents	- Introduction to application analysis and design - Design patterns - S.O.L.I.D. Principles - Basics of visual modeling (UML) - Class diagrams - Sequence and communication diagrams
Prerequisites	Knowledge for object-oriented development, database integration and integration of unit tests in C# or Java is required.
Assessment Methods	- Moodle Tests - Presentations - Semester project
Recommended Reading and Material	- C#: https://docs.microsoft.com/en-us/visualstudio/designers/getting-started-with-wpf - C#: http://han.technikum-wien.at/han/ebookcentral/ebookcentral.proquest.com/lib/ftw/detail.action?docID=5327214 - C#: https://www.syncfusion.com/succinctly-free-ebooks/wpf-succinctly - Java: https://openjfx.io/ - Java: https://link-1springer-1com-1000342kv0273.han.technikum-wien.at/book/10.1007/978-3-658-02836-7 - Java: https://link-1springer-1com-1000342we0744.han.technikum-wien.at/book/10.1007/978-3-658-30494-2 - Material (Slides, Videos, selected Articles) via Moodle
Attendance	mandatory
Comments	

Innovation Lab 2

Degree programme	BIF
Semester	4
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. Recognition: InnoLab 2 cannot be recognized. This means that if you are studying in the 4th semester, you must also complete InnoLab 2, regardless of whether you have already completed this course before (possibly when repeating it).

Requirements Engineering

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Requirements define the Needs of customers and stakeholders in a formalized way,so that the Features of a product can be implemented correctly (Needs<-->Requirements<-->Features).Requirements engineering is the process of elicitation, documentation, verification and management of requirements.Insufficient requirements engineering can lead to high follow-up costs(check Berlin Airport, https://www.engineering.com/story/germanys-ghost-airport-berlins-brandenburg).In this course you will learn the basics of requirements engineering in both classic and agile project environments.In doing so, emphasis is placed on both the theoretical basics and the practical application.After successfully completing this course,you will be able to comprehensively collect requirements, document them correctly and follow them up in practice.
Teaching methods	integrated course, flipped classroom principle
Learning outcome	After passing this course successfully students are able to ... - justify the need for requirements engineering - carry out requirements elicitation as appropriate - carry out requirements documentation correctly - correctly document requirements based on models - define and manage requirements in agile project settings - develop SW according to the BDD approach (Behavior-Driven-Development)
Course contents	- Requirements Engineering basics - Requirements documentation and modeling - Agile requirements engineering - User Story mapping - Behavior-Driven-Development
Prerequisites	none

Assessment Methods	- Knowledge tests - learning assignments - final exam
Recommended Reading and Material	- Requirements Engineering Fundamentals: A Study Guide for the Certified Professional for Requirements Engineering Exam Foundation Level – IREB compliant, 2nd Edition
Attendance	mandatory
Comments	Flipped Classroom Concept: preparatory literature study - assignments- 3 x 4h class-room units - final exam

Game Content Creation

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Teaching the basics of pre-production and the development of a coherent visual identity (art direction, concept art, animation, VFX, UI)
Teaching methods	Mixture of attendance and self-study phases
Learning outcome	After passing this course successfully students are able to ... - Identify different types of 2D graphics - Reflect on the advantages and disadvantages of using AI models Analyze video games and other media in terms of the art direction applied - Confident and unafraid to create concept drawings, storyboards and mockups - Apply principles of animation - Evaluate and develop user interfaces that support the gaming experience
Course contents	- Art Direction - Concept Art - Animation - VFX - Film Theory

	- Storyboards - UI - Player Perspective
Prerequisites	none
Assessment Methods	- 30% Individual Assignment - 70% Group Assignments
Recommended Reading and Material	
Attendance	according to the guidelines
Comments	

Game Development Grundlagen

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course gives an overview of topics related to game development as well as its challenges. It takes a look on all the things required to develop and publish a game on game consoles and tries to covers the larger area of technical implementation, game design, cooperation and communication within the team as well as some business and legal aspects.
Teaching methods	integrated course
Learning outcome	After passing this course successfully students are able to ... - To explain the structure of a commercial game production and to describe the process for releasing an indie game - Describe the basic functionality of modern game engines - to use the central functions and modules of Unity and to expand them with scripts - Load assets from external tools into the engine and process them there - To explain the basic processes of a Game AI or simple physical facts and to implement them in Unity

	- to design simple games, to create, implement and test the necessary software architecture - Implement acceleration techniques
Course contents	- Basic structure of a game - Distribution of roles and teamwork - Structure and framework of a commercial game production, economic and legal aspects - Game engine introduction and architecture - Unity basics - Game loop - Data Driven Development and Scripting - AI basics for games - Pathfinding - Collision detection
Prerequisites	Programming knowledgeInto gaming
Assessment Methods	- Code Reviews - Projects in small groups
Recommended Reading and Material	- Introduction to Game Design, Prototyping, and Development, Gibson Jeremy - ISBN: 0136619940 - The Art of Game Design: A Book of Lenses, Jesse Schell - ISBN: 1138632058 - A Theory of Fun for Game Design, Raph Koster - ISBN: 1932111972
Attendance	Yes
Comments	

Computer Science Seminar

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	In this integrated course the focus is on developing and implementing didactic knowledge and concepts in the field of eLearning and eDidactics. Examples in the courses serve as an

	introduction to the topic. Feedback loops from other students (peer review – critical friend feedback) and the course supervisors allow a didactically valuable implementation.During the semester a Moodle course is didactically developed - therefore an eCourse concept is elaborated, an introduction "icebreaker" is planned, a teaching video is shot and learning assignments are created. For this purpose, groups are formed to work together on a computer science topic proposed by the degree program. The classes show methods to prepare the content according to the learning outcomes.
Teaching methods	integrated course
Learning outcome	After passing this course successfully students are able to ... - show and reflect the possibilities, range and limits of the application of eLearning. - reproduce the most important terms in eLearning. - describe which eDidactic methods can be used to implement it in an eCourse. - develop problems and feedback in an eLearning context. - use eLearning tools and feedback for content and application development. - design, implement and critically evaluate learning packages. - plan, implement and evaluate video trainings. - familiarize yourself with a new topic in computer science. - establish a connection between the new topics and practice.
Course contents	- Familiarization with a (new) topic and implementing a didactic e-learning concept in Moodle - Introduction eLearning & eDidactics - eLearning Tools & Moodle Basics - Icebreakers & Video Trainings - Video Trainings & Content Management - Learning Assessments - Finalisation Learning Package
Prerequisites	All courses of previous semestersUser knowledge Moodle
Assessment Methods	- 20% eCourse Concept - 50% implementation - 10% CFF - 10% presentation - 10% Lerntagebuch
Recommended Reading and Material	- depending on chosen topic

Attendance	Attendance is required
Comments	-

Android App Development

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	Smartphones, tablets and other mobile devices along with associated apps and services have had a disruptive impact on our society. More and more applications migrate from a classic desktop environment to mobile platforms. This allows for better integration into daily routines and thus enables the support for new use cases. As a consequence, there is a high demand for specialists in the area of mobile computing and mobile app development which are able to implement these use cases.In terms of market share, Android is the largest mobile operating. It powers devices from a large number of different manufactures and different formfactors. Google provides an extensive toolkit for developing Android apps which is constantly evolving and expanding. As a result, knowing and understanding this toolkit, its building blocks and the associated concepts is required if you want to develop native Android applications. Furthermore it helps you to understand the technical possibilities and limitations of such apps and allows for identifying and evaluating innovation potential.
Teaching methods	Theoretical preparation, as well as in-depth exercises in the self-study phases. Group discussions and joint practical examples in the attendance phases.
Learning outcome	After passing this course successfully students are able to ... - develop advanced Android applications using the current development tools and IDEs - name and explain advanced design patterns and best practices for developing Android applications - structure and build your own Android application implementations according to these design patterns and best practices

Course contents	- Developing smartphone applications for Android - Design patterns for Android applications - Basics of the Kotlin programming language - Android application design (structuring and developing UI-code, threading, asynchronous web requests, data persistance) - Pitfalls and best practices (memory management, debugging, crash-logs, performance optimization)
Prerequisites	Basics of programming in an object-oriented language
Assessment Methods	- Assignments Part (75 %) 6 Assignments 100 (per assignment) - Theoretical Part (25 %) Theory test 100
Recommended Reading and Material	- see Moodle course for each attendance and self-study phase
Attendance	see program guidelines
Comments	

Data Science und Machine Learning

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The course offers a comprehensive overview of the fundamental principles and techniques of machine learning. It covers a wide range of topics, including supervised and unsupervised learning methods such as neural networks, decision trees, and clustering. In addition to theoretical foundations, the course places a strong emphasis on practical applications, giving participants the opportunity to analyze real data and develop their own models through projects and exercises.
Teaching methods	integrated course
Learning outcome	After passing this course successfully students are able to ... - prepare, visualize and evaluate structured databases using Excel and Tableau. - read a data set into an IPython notebook, processing it in this

	development environment and exploring it using descriptive statistics and selected statistical methods. - recognize relationships between a dependent and one or more independent variables and use regression methods to develop a prediction model. - classify data points in the multi-dimensional feature space with the help of simple and monitored learning processes (nearest neighbors, decision trees). - evaluate and improve the performance of classification and regression processes. - cluster data points in the multi-dimensional feature space using the kMeans method and to determine the optimal number of clusters.
Course contents	- Data preparation, visualization and evaluation - Use of Python in data science - Regression analysis - Time series regression - classification - Performance evaluation and improvement - Cluster and principal component analysis
Prerequisites	Programming in Python, Probability and Statistics, Linear Algebra and Calculus
Assessment Methods	- Exercises, Project Presentation, Exam
Recommended Reading and Material	
Attendance	obligatory
Comments	

Business English

Degree programme	BIF
Semester	4
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes

	and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English - hold a Pechakucha presentation, presenting either a marketing analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings - effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	B2 level English, positive grade in Technical English
Assessment Methods	- 10% Vocabulary Test - 30% Self-studies and class preparation and discussion - 60% Business PechaKucha presentation and assessed presentation plan
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory

Comments	none

Network Security

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	in this course you will learn security aspects in networks (technology classification, OSI security architecture, TCP/IP security challenges, tunneling protocols according OSI layers, mechanisms and applications, WLAN security, security of network services and web applications), firewall technologies, intrusion detection & prevention systems and network segmentation.
Teaching methods	integrated course, flipped classroom principle
Learning outcome	After passing this course successfully students are able to ... - list requirements for secure communication (networks, services, distributed applications) and describe the procedures and protocols required for this purpose, - know the different categories of IDS/IPS network devices and explain their advantages and disadvantages, - know the different categories of perimeter security devices and explain the differences, - know methods to secure simple networks, wired as well as wireless.
Course contents	- Physical Security - Secure Network Design - Secure Site Connections - IDS/IPS - Intrusion Detection & Prevention Systems - Secure Protocols (SSH, TLS, IPsec...) - 802.1x and Access Control - Authentication - DDOS mitigation
Prerequisites	Fundamentals of Computer ScienceIT Network fundamentalsOperating Systems Basics (Windows, Linux)

Assessment Methods	- Practical exercises - Final Exam (theory)
Recommended Reading and Material	- Cryptography and Network Security: Principles and Practice, Global Edition – William Stallings (2016) - Network Security Essentials: Applications and Standards, Global Edition – William Stallings (2016) - IT-Sicherheit für TCP/IP- und IoT-Netzwerke: Grundlagen, Konzepte, Protokolle, Härtung – Steffen Wendzel (2021) - IT-Sicherheit Konzepte – Verfahren – Protokolle – Claudia Eckert (2018)
Attendance	Mandatory.
Comments	

Continuous Integration

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course provides in-depth knowledge in the field of Continuous Integration (CI) and Continuous Delivery/Deployment (CD) as well as the practical application of CI servers. CI has become a standard in modern software development, enabling faster and error-free delivery of software products. Students will become familiar with relevant CI tools such as Jenkins, GitHub Actions, GitLab CI, Circle CI, and Azure DevOps. During the course, students will develop their own CI pipeline using at least two different CI servers, applying architecture and design principles that they will learn.
Teaching methods	The integrated course combines lectures, practical examples, homework assignments, self study, supervised project work, exercises, and tests.
Learning outcome	After passing this course successfully students are able to ... - apply the principles of semantic versioning to their software projects - set up and configure a CI server - compile, test, package, and deploy existing software on a target

	system - analyze the importance of integrating development and operations (DevOps) - understand and implement methods and processes for optimized collaboration between development and operations
Course contents	- Semantic Versioning - Advanced Git topics - Motivation and benefits of CI - Setting up and configuring a CI server (e.g., Jenkins, GitHub Actions, GitLab CI, Azure DevOps, Circle CI) - Configuring build jobs and pipelines - Utilizing build tools - Using tools such as AWS (infrastructure provisioning), Docker Compose (container management), SonarQube (static code analysis), Posthog (analytics, A/B testing, feature flags), Snyk (code and container security) - Application release automation - Organizational and economic aspects of DevOps
Prerequisites	Experience in software development and project implementationBasic knowledge of software testingBasic familiarity with version control using Git
Assessment Methods	- Practical part 70% (semester project and exercises) - Theoretical exam 30% (closed book Moodle multiple-choice test)
Recommended Reading and Material	- Ian Sommerville: Engineering Software Products. An introduction to modern software engineering (Pearson) - Humble, Farley: Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation
Attendance	mandatory
Comments	

System Hardening

Degree programme	BIF
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	In this course you learn security basics of operating systems as well as threats, defense mechanisms and hardening of operating systems (specifics of Windows and Linux).
Teaching methods	integrated course, flipped classroom principle
Learning outcome	After passing this course successfully students are able to ... - explain the need for secure systems, - identify basic methods for securing operating systems, - reflect different tasks of security measures of operating systems.
Course contents	- Identity and Access Management - Administration and Remote Management - Windows Server Security - Windows Client Security - Linux Server Security - Linux Client Security - Secure Active Directory - SELinux - AppArmore
Prerequisites	Basics of computer scienceBasics of IT infrastructureBasics of router and switching configuration
Assessment Methods	- Practical exercises - Final Exam (theory)
Recommended Reading and Material	- Mastering Linux Security and Hardening: Protect your Linux systems from intruders, malware attacks and other cyber threats, 2nd edition – Donald A. Tevault (2020) - Mastering Windows Security and Hardening: Secure and protect your Windows environment from intruders, malware attacks and other cyber threats – Mark Dunkerley and Matt Tumbarello (2020) - Practical Linux Security Cookbook – Tajinder Kalsi (2018)
Attendance	Mandatory.
Comments	

Software Engineering 2 Labor

Degree programme	BIF
Semester	4
Course methods	LAB
Language	English

ECTS Credits	5.00
Incoming places	Limited
Course description	The course is an introduction to UI development in Java or C# .NET. The main focus is on the separation between the user interface (graphically) and the appropriate code for controlling it. In professional software development environments, it is not sufficient to just write working code. It is important to structure the code in a comprehensible way considering standard patterns and documentation principles. By respecting the concepts of this lecture we improve the overall quality, the readability, traceability, expandability and interchangeability.You can choose between C# and Java for the development process during the full course.
Teaching methods	The theory part consists of self-study phases, Moodle Tests and attendance. The practical part is a course project in which all learned content is applied.
Learning outcome	After passing this course successfully students are able to ... - implement a graphical user interface with the help of WPF or JavaFX - use a logging library to document and track runtime behavior of an application - create simple reports with tables and images using a PDF library - design and implement loosely coupled classes and interfaces - plan the deployment of an application and identify possible critical paths - use LINQ or Java Streams to implement functional programming concepts - consider SOLID principles during development of object-oriented software - detect, name and extend design patterns after Erich Gamma in object oriented software - reproduce visual modeling basics that include modeling goals and the concepts of object orientation - model class diagrams to visualize the classes of a software system and their relationships, as well as their behavior and properties - model sequence and communication diagrams to represent communication between classes
Course contents	- Introduction to application analysis and design - Design patterns - S.O.L.I.D. Principles

	- Basics of visual modeling (UML) - Class diagrams - Sequence and communication diagrams
Prerequisites	Knowledge for object-oriented development, database integration and integration of unit tests in C# or Java is required.
Assessment Methods	- Moodle Tests - Presentations - Semester project
Recommended Reading and Material	- C#: https://docs.microsoft.com/en-us/visualstudio/designers/getting-started-with-wpf - C#: http://han.technikum-wien.at/han/ebookcentral/ebookcentral.proquest.com/lib/ftw/detail.action?docID=5327214 - C#: https://www.syncfusion.com/succinctly-free-ebooks/wpf-succinctly - Java: https://openjfx.io/ - Java: https://link-1springer-1com-1000342kv0273.han.technikum-wien.at/book/10.1007/978-3-658-02836-7 - Java: https://link-1springer-1com-1000342we0744.han.technikum-wien.at/book/10.1007/978-3-658-30494-2 - Material (Slides, Videos, selected Articles) via Moodle
Attendance	mandatory
Comments	

Sports Engineering & Ergonomics

Materials and Technology for Performance Apparel

Degree programme	BSE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Materials are not only important in connection with appliances, but also for clothing. Due to their structure, functional materials have very specific properties, which are explained to the students in this

	course. They learn to recognize, test and analyze them.
Teaching methods	The theoretic fundamentals conveyed in impulse lectures of presence units are complemented via preparation, presentation and discussion of specific case studies by the students. The gained competencies are applied within a project work and are ultimately evaluated in a written exam.
Learning outcome	After passing this course successfully students are able to ... - recognize different functional materials and to derive their production technology. - describe the connection between structure and functionality of high-tech materials in the sportswear sector. - analyze requirements for sports garments and to select appropriate materials and production technologies. - conceive ergonomic designs for specific target groups select appropriate test methods for the evaluation of material properties. - critically assess sustainability in the life cycle of high-tech materials.
Course contents	- Materials science: Fibers & Membranes - Manufacturing technologies - Material testing of fibers & membranes - Physiology (thermoregulation)
Prerequisites	•Fundamentals of Physics for Engineering Sciences (PHY1)•Fundamentals of Anatomy and Physiology (APHYS)•Fundamentals of Biomechanics and Ergonomics (BIOME)•Materials Testing Plastics (WERKS) Industrial Design (INDUS)•Auswahl von Materialien und Herstellungsverfahren (MATER)
Assessment Methods	- Details see Moodle Course
Recommended Reading and Material	- Hayes, S. G., & Venkatraman, P. (Eds.). (2018). Materials and technology for sportswear and performance apparel. CRC Press - Shishoo, R. (Ed.). (2015). Textiles for sportswear. Elsevier. - McLoughlin, J., & Sabir, T. (Eds.). (2018). High-Performance Apparel: Materials, Development, and Applications. Woodhead Publishing.
Attendance	According to FHTW regulations (Satzung § 5)
Comments	

Business English

Degree programme	BSE

Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English - hold a Pechakucha presentation, presenting either a marketing analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings - effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies.
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	B2 level English, positive grade in Technical English
Assessment Methods	- 10% Vocabulary Test

	- 30% Self-studies and class preparation and discussion - 60% Business PechaKucha presentation and assessed presentation plan.
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	none

Mechanical Engineering

Business English

Degree programme	BMB
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English

	- hold a Pechakucha presentation, presenting either a marketing analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings - effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	
Assessment Methods	- 10% Vocabulary Test - 30% Self-studies and class preparation and discussion - 60% Business PechaKucha presentation and assessed presentation plan.
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	none

Business Informatics

Distributed Systems

Degree programme	BWI
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course introduces the development of component-based (in particular service-oriented) software systems.
Teaching methods	Lectures, project work and self-study with practical examples and supervised project work
Learning outcome	After passing this course successfully students are able to ... - implement component-based systems using a selected programming language - implement service-oriented systems using a selected programming language - analyzing existing monolithic systems and converting them into flexible, distributed systems - exchange data asynchronously between (sub)systems using message queues, file transfer, RPC or shared databases - encapsulate data layer functionalities using O/R Mappers and make them available using interfaces - consider and apply design principles in the context of object orientation in the programming process
Course contents	- Component Based System Engineering - Service-oriented System Components - Various principles of system design - SOA related to system components - UML modeling (component/sequence diagrams)
Prerequisites	Basics in software development with a selected programming language. Basic knowledge of software architecture.
Assessment Methods	- Multimodal: - Theoretical assessment (Moodle MC test) - Project work (two Milestones)
Recommended Reading and Material	- see Moodle
Attendance	mandatory
Comments	There are different teaching times: full-time (during the day, abbreviation VL) and part-time (afternoons/evenings, abbreviation BB)

Hydrogen Engineering

Business English

Degree programme	BHE
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English - hold a Pechakucha presentation, presenting either a marketing analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	B2 level English, positive grade in Technical English
Assessment Methods	- 10% Vocabulary Test

	- 30% Self-studies and class preparation and discussion - 60% Business PechaKucha presentation and assessed presentation plan
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	none

Mechatronics/Robotics

Business English

Degree programme	BMR
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English

	- hold a Pechakucha presentation, presenting either a marketing analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings - effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	B2 level English, positive grade in Technical English
Assessment Methods	- 10% Vocabulary Test - 30% Self-studies and class preparation and discussion
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	none

Materials Science

Degree programme	BMR
Semester	4
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Have an insight into the world of materials science! 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 to understand why

	materials behave like they do and establish an understanding about the various material's processing and treatments. We will focus here on metals.
Teaching methods	Integrated course
Learning outcome	After passing this course successfully students are able to ... - have a basic understanding of the properties of materials - distinguish between elastic and plastic deformation - to read phase diagrams - have basic understanding about ferrous and non-ferrous metals - have a basic understanding of steelmaking - have a basic understanding of the heat treatments of steel - have a basic understanding of material selection according to Ashby - have a basic understanding of the different methods of material testing
Course contents	- Classification of Materials - Structures of Materials (Interatomic Bonding, Crystal Structure, Crystal Defects) - Material‘s Properties - Alloying and Casting - Phase Diagrams - Microstructure - Fe-C phase diagram - The Fe-C Phase Diagram - Steelmaking (Blast Furnace, BOP, DRI, Electric Arc furnace,...) - Heat Treatment Process - Designation - Fe-C Categories - Nonferrous Alloys - Materials Testing - Material Selection - Difference between Metals, Polymers, Ceramics -
Prerequisites	Basic knowledge according to admission requirements for the bachelor’s program
Assessment Methods	- Final Exam - exercises
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	none

Manufacturing Engineering

Degree programme	BMR
Semester	4
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 for manufacturing 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

Semester Project

Degree programme	BMR
Semester	4
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	In this module, the elaboration, project planning and breakdown into work packages in self / team organization should take place on the basis of a technical task. In the module, a practical project from task definition to validation / verification of the results should be carried out independently or as a team through self-determined project management.
Teaching methods	Integrative lecture, group exercises
Learning outcome	After passing this course successfully students are able to ... - to successfully conceptualize a practice / research project based on a formulated task and, if necessary, to implement it. - draw up and implement a project / work plan in the dimensions of time, financial requirements and use of resources. - carry out a feasibility study at a suitable time for the project and adapt the project / work plan accordingly as required - to create documentation that also meets scientific and technical requirements
Course contents	- Processing of a subject-specific task, according to the subject area and the level of training - Selection and application of suitable project management methods - Application of the relevant specific technical principles to achieve the project goals (independently or in a team) - Presentation, discussion and critical reflection on the results
Prerequisites	Project Management
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Timinger H.: Projektmanagement, (aktuelle Auflage)
Attendance	100%
Comments	none

Electronic Engineering

Business English

Degree programme	BEL
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description

In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary in English.

Teaching methods

Learning outcome

After passing this course successfully students are able to ...
- use a wide range of business vocabulary in English,
- hold a PechaKucha presentation in English, presenting either a marketing analysis of, a CSR (Corporate Social Responsibility) strategy for, or a financial analysis on a company of their choice, understand and deconstruct a business plan in English,
- understand how products can be marketed using the English language,
- understand how products can be marketed using English,
- use a wide variety of techniques to aid communication in international teams and meetings using the English language,
- effectively present data and trends using the English language,
- understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) using the English language
- and apply them to different companies.

Course contents

- Business topics (marketing, finance, business plan …) in English
- Meetings in English
- ELF ("English as a lingua franca") communication

	- CSR (Corporate Social Responsibility) and Business Ethics in English - Business presentations in English
Prerequisites	Course "Technical English"
Assessment Methods	- Vocabulary test, self-studies, class preparation and discussion, PechaKucha presentation and assessed presentation plan
Recommended Reading and Material	- R. Murphy, English Grammar in Use, 5th Edition, 2019, Klett Verlag - University of Minnesota, Business Communication for Success, 2015, ISBN 13-9781946135056
Attendance	Obligatory
Comments	

Microelectronic Design

Degree programme	BEL
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course provides introductory know-how on the design methodology, implementation and verification of digital microelectronic circuits and systems using contemporary hardware description languages and programmable logic devices (FPGAs) as target technology
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - explain the importance and history of microelectronics by means of application examples, - describe simple digital microelectronic circuits and systems consisting of combinatorial and sequential logic, based on a contemporary hardware description language such as VHDL, - verify the functional correctness of the developed designs by using an industrial digital logic simulator, - synthesize and implement these designs on a contemporary target technology (FPGA)

	- and apply the acquired knowledge to a final project.
Course contents	- Overview on the importance and history of microelectronics - Introduction to a contemporary hardware description language like VHDL - Design of combinational logic (simple gates, decoders, multiplexers, adders, subtractors ...) with a contemporary hardware description language - Description of sequential logic (different types of flip-flops and registers, counters, state machines ...) using a contemporary hardware description language - Verification of digital microelectronic circuits and systems by using an industrial digital simulator - Synthesis and implementation of digital circuits and systems using industrial EDA tools and modern microelectronic target technologies (FPGAs) - Final project
Prerequisites	Fundamentals of digital systems, basic programming skills
Assessment Methods	- course-immanent performance assessment
Recommended Reading and Material	- P. Ashenden, The Designer's Guide to VHDL, 2008, Morgan Kaufmann, ISBN 0120887851 - C. Unsalan, B. Tar, Digital System Design with FPGA: Implementation Using Verilog and VHDL, 2017, McGraw Hill
Attendance	mandatory
Comments	

Business English

Degree programme	BEL
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a

	product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary in English.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - use a wide range of business vocabulary in English, - hold a PechaKucha presentation in English, presenting either a marketing analysis of, a CSR (Corporate Social Responsibility) strategy for, or a financial analysis on a company of their choice, understand and deconstruct a business plan in English, - understand how products can be marketed using the English language, - understand how products can be marketed using English, - use a wide variety of techniques to aid communication in international teams and meetings using the English language, - effectively present data and trends using the English language, - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) using the English language - and apply them to different companies.
Course contents	- Business topics (marketing, finance, business plan …) in English - Meetings in English - ELF ("English as a lingua franca") communication - CSR (Corporate Social Responsibility) and Business Ethics in English - Business presentations in English
Prerequisites	Course "Technical English"
Assessment Methods	- Vocabulary test, self-studies, class preparation and discussion, PechaKucha presentation and assessed presentation plan
Recommended Reading and Material	- R. Murphy, English Grammar in Use, 5th Edition, 2019, Klett Verlag - University of Minnesota, Business Communication for Success, 2015, ISBN 13-9781946135056
Attendance	Obligatory
Comments	

Microelectronic Design

Degree programme	BEL
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

The course provides introductory know-how on the design methodology, implementation and verification of digital microelectronic circuits and systems using contemporary hardware description languages and programmable logic devices (FPGAs) as target technology

Teaching methods

Learning outcome

After passing this course successfully students are able to ...
- explain the importance and history of microelectronics by means of application examples,
- describe simple digital microelectronic circuits and systems consisting of combinatorial and sequential logic, based on a contemporary hardware description language such as VHDL,
- verify the functional correctness of the developed designs by using an industrial digital logic simulator,
- synthesize and implement these designs on a contemporary target technology (FPGA)
- and apply the acquired knowledge to a final project.

Course contents

- Overview on the importance and history of microelectronics
- Introduction to a contemporary hardware description language like VHDL
- Design of combinational logic (simple gates, decoders, multiplexers, adders, subtractors ...) with a contemporary hardware description language
- Description of sequential logic (different types of flip-flops and registers, counters, state machines ...) using a contemporary hardware description language
- Verification of digital microelectronic circuits and systems by using an industrial digital simulator
- Synthesis and implementation of digital circuits and systems using industrial EDA tools and modern microelectronic target technologies (FPGAs)
- Final project

Prerequisites	Fundamentals of digital systems, basic programming skills
Assessment Methods	- course-immanent performance assessment
Recommended Reading and Material	- P. Ashenden, The Designer's Guide to VHDL, 2008, Morgan Kaufmann, ISBN 0120887851 - C. Unsalan, B. Tar, Digital System Design with FPGA: Implementation Using Verilog and VHDL, 2017, McGraw Hill
Attendance	mandatory
Comments	

Information and Communication Systems and Services

Business English

Degree programme	BIC
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English

	- hold a Pechakucha presentation, presenting either a marketing analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings - effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	B2 level English, positive grade in Technical English
Assessment Methods	- 10% Vocabulary Test - 30% Selbststudium und Vorbereitung und Diskussion in der Klasse - 60% Business PechaKucha Präsentation und bewerteter Präsentationsplan.
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	None

IT Security Basics

Degree programme	BIC
Semester	4
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	BIC

Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description

Software security is the umbrella term for software designed to continue to function properly in the face of malicious attacks. Security as part of the software development process is an ongoing process involving people and processes that ensures the confidentiality, integrity and availability of the application. Secure software is the result of security conscious software development processes where security is built in and therefore software is developed with security in mind

Teaching methods

Learning outcome

After passing this course successfully students are able to ...
- Establish identity & access management in (web) applications
- Recognize the 10 most common security vulnerabilities in software
- Use established authentication methods (HTTP Digest, Single Sign On/SAML/OAuth2)
- Development of secure applications and assessment of current security risks
- Evaluate software projects using a Secure Software Lifecycle
- Assessment of threats to applications using a risk matrix
- Basics for conducting a security assessment / pentest
- Software development: Secure by design, secure by default

Course contents

- Application Security
- Secure by design principles
- Secure authentication in SW
- Web Application Security
- Identity & Access Management
- Risikobewertung in SW / Threat Modeling
- DB Security

Prerequisites

Knowledge of common web languages (HTML, JS, CSS, PHP, AJAX)Knowledge of object-oriented languages (Java || C#. / .net)Knowledge of handling databases (mySQL or Oracle)Basic knowledge of using LinuxKnowledge of network protocols: Ethernet, IP/ARP, TCP/UDP, DNS, Application Layer protocols, Transport Layer Security or http/s, s/ftp, ssh,...

Assessment Methods	
Recommended Reading and Material	- SAML Specifications 2.1 - OAuth 2.0 Autorization Framework - RFC6749 - OWASP 10 2021++/-- - NIST Secure Software Development Framework - OWASP Secure Coding Guideline
Attendance	
Comments	

Embedded Systems

Degree programme	BIC
Semester	4
Course methods	LAB
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This module introduces real-time software design on STM32 microcontrollers using FreeRTOS. Students learn how to structure embedded applications into tasks, apply real-time scheduling, and integrate microcontroller peripherals (GPIO, timers, ADC, PWM, UART/SPI/I²C) in a safe and testable way. A sequence of small assignments builds practical skills across the semester.
Teaching methods	Hands-on lab sessions with guided exercises on STM32 (STM32CubeIDE + HAL) Short demos and live coding of RTOS patterns (tasks, queues, semaphores, ISRs) Code walkthroughs and lightweight debugging (UART logging, breakpoints, assertions) Multiple small assignments with iterative feedback
Learning outcome	After passing this course successfully, students are able to … - Explain core RTOS concepts (tasks, priorities, context switching, scheduling, tick rate). - Use FreeRTOS synchronization and communication (queues, semaphores/mutexes, event groups, timers). - Write ISR-safe embedded code and use the correct FreeRTOS FromISR APIs.

- Integrate STM32 HAL peripherals with RTOS (GPIO, timers, ADC, PWM, UART/SPI/I²C).
- Reason about basic real-time behavior (periods, deadlines, task interactions) and avoid common pitfalls.
- Structure code for readability and maintainability (layered design, documentation, version control).

Course contents

- RTOS foundations: tasks & priorities, preemption, scheduler tick, context switching, timing services.
- Sync & IPC: binary/counting semaphores, mutexes & priority inversion, queues, event groups, software timers.
- ISRs & RTOS: interrupt design, ISR vs. task work split, FromISR APIs, latency considerations.
- STM32 peripheral integration with HAL: GPIO, timers (periodic tasks, capture/compare), PWM, ADC, UART/SPI/I²C under RTOS.
- Assignments: several small RTOS-focused tasks throughout the semester (e.g., periodic sensing, UART command handling, PWM control), each assessed independently.

Prerequisites

- Prior course or equivalent experience in microcontroller programming (e.g., Microcontroller Software Design, STM32 + HAL).
- Solid C programming basics (functions, pointers, structs, …).
- Basic embedded concepts (GPIO, timers, PWM, ADC, UART; interrupts; debouncing).
- Using an IDE and debugger (STM32CubeIDE, breakpoints, stepping, watch variables) and basic UART logging.

Assessment Methods

4 Assignments + 1 Short check/Quiz

Recommended Reading and Material

FreeRTOS

- FreeRTOS Kernel Documentation (concepts and API reference) – freertos.org
- “Mastering the FreeRTOS Real-Time Kernel” (official tutorial book, free PDF) – github.com

STM32 tools & HAL

- STM32CubeIDE User Guide – UM2609 (project setup, build, debug) – st.com
- STM32 HAL/LL Drivers documentation for the STM32L4 family - UM1884 (peripheral APIs used in labs) – st.com

Good practice (optional)

- Barr Group Embedded C Coding Standard (BARR-C:2018) for readable, robust code

Information directly from used tool supplier:

- STM32CubeIDE product page (downloads & docs) – st.com
- FreeRTOS Documentation hub (getting started, API, community) – freertos.org

Attendance	100% mandatory
Comments	none

Biomedical Engineering

Business English

Degree programme	BBE
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English - hold a Pechakucha presentation, presenting either a marketing

	analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings - effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	B2 level English, positive grade in Technical English
Assessment Methods	- 10% Vocabulary Test - 30% Self-studies and class preparation and discussion - 60% Business PechaKucha presentation and assessed presentation plan.
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	none

Basics of Prosthetics

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Introduction to the basic principles of protection
Teaching methods	

Learning outcome	After passing this course successfully students are able to ... - to name the causes and level of amputation. - Describe different fitting options. - To select materials for prostheses and orthoses. - Orthopaedic products and their specifications for describe.
Course contents	- Causes of amputation - Representation of the supply process - Amputation level - Materials in orthopaedic technology - Mechanics and biomechanics in orthopaedic technology - Supply options related to Amputation level - Shaft connection
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Molecular Genetics

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The lecture Molecular Genetics provides an overview of the structure and functions of prokaryotes and eukaryotic cells. Molecular mechanisms in prokaryotic and eukaryotic cells are presented, focusing on relevant properties of proteins, RNA and DNA, and the fundamental biological processes of replication, transcription and translation, and regulation of gene expression.
Teaching methods	e-learning units on the respective topics with voluntary self-checks, supporting online teaching material (videos, animations simulations), classroom units with discussion of the topics, and group work with

	subsequent joint discussion of the results.
Learning outcome	After passing this course successfully students are able to ... - general molecular mechanisms in pro- and eukaryotic cells and compare them. - explain the fundamental biological processes of replication, transcription and translation at the molecular genetic level - reflect the different biological properties of proteins, RNA and DNA - explain the molecular interactions that control gene expression
Course contents	- Introduction and basics of molecular genetics - Cell cycle and mitosis/replication - Sexual reproduction and meiosis/recombination - Transcription - Translation - Genetics of bacteria - gene regulation
Prerequisites	ILV Biochemie und Molekularbiologie (BIOMO)
Assessment Methods	- written final exam (80% of final grade), groupworks in class (20% of final grade)
Recommended Reading and Material	- Molekulare Genetik - Rolf Knippers, Thieme Verlag - Genetik - Allgemeine Genetik - Molekulare Genetik - Entwicklungsgenetik - Wilfried Janning; Elisabeth Knust, Thieme Verlag
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	

Computational Bioanalysis

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Fundamentals of computational bioanalysis

Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - search literature databases with regard to certain criteria. - perform basic sequence comparisons at DNA and protein level - create protein structures in 3D. - analyze gene expression data sets.
Course contents	- Literature databases - Sequence comparisons (BLAST) on protein and DNA level - Protein Prediction Tools - protein structures - Gene Enrichment Analysis, gene expression data sets
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Telemedicine & eHealth

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The course introduces telemedicine and eHealth. The knowledge acquired helps in particular with the implementation of digitally supported workflows in the entire health care system. A recent example is the contactless prescription of medicines during the COVID-19 epidemic. Such systems improve care by providing complete information in the right place for the people who are entitled to it. Clinical decision support and medical research systems are topics of the course. Graduates of this course are familiar with the application area "medicine" as well as with basic IT knowledge. They can therefore make significant contributions to the overall success,

	e.g. in the creation of user requirements and system requirements, and also in teams in the implementation of applications.
Teaching methods	Based on introductory lectures, groups of students will explore specific application fields. They will apply the skills from the course to these fields, to gain additional hands-on-experience. A visit to dHealth, the largest yearly scientific eHealth conference in Austria, will complete this intensive round-trip.
Learning outcome	After passing this course successfully students are able to ... - to classify existing systems or systems planned for the future according to different classification systems. - to identify the different types and essential characteristics of data storage, networks and transmission technologies in the health care sector and to analyse their technical properties and performance criteria. - understand the concept and the different levels of interoperability in the health care system and explain which standards can be used at which level. - Relate and balance the benefits and hazards of healthcare ICT applications.
Course contents	- Introduction and definition of terms: eHealth, mHealth, pHealth, telemedicine - Healthcare challenges and eHealth solutions - Basic technologies (networks, mobile and wireless) - Legal and health policy General conditions - Interoperability and standards - The Electronic Health Record / ELGA - Patient-centred care (home, health and telemonitoring) - Information and communication technology in the biomedical research - Future aspects and resources for a deepening of the Field of expertise
Prerequisites	Basic knowledge of medical specialties and the structure of the healthcare system
Assessment Methods	- Exam - Interactive presentation and discussion of group projects
Recommended Reading and Material	- Edward H. Shortliffe, James J. Cimino (Editors): Biomedical Informatics - Computer Applications in Health Care and Biomedicine. Springer Science+Business Media New York, 5th Edition, 2021, ISBN 978-3-030-58720-8, https://doi.org/10.1007/978-3-030-58721-5.

	- Sonali Vyas, Deepshikha Bhargava: Smart Health Systems - Emerging Trends. Springer Nature Singapore Pte Ltd. 2021, ISBN 978-981-16-4200-5, https://doi.org/10.1007/978-981-16-4201-2.
Attendance	
Comments	

Data Management in Medicine

Degree programme	BBE
Semester	4
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Basics of medical data management
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - List and explain common data formats for medical data - Balance the basic data exchange mechanisms - to save sample data sets accordingly
Course contents	- medical data formats - Storage systems in hospitals - Data storage of medical data
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Engineering Heart, Lung and Circulation

Degree programme	BBE
Semester	4
Course methods	ILV

Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Introduction to technology and definition of heart, lung and circulation technology
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - select suitable methods for measuring pressure and flow in the lungs and circulation for given issues and justify this selection. - compare different methods for ECG acquisition and detect and eliminate signal interference. - to describe the essential components of pacemakers and to name and justify the settings for different heart diseases. - to describe the sequence of spirometric and oxymetric examinations and to discuss the possibilities and limitations of measurement methods used. - to name the essential aspects for the electrical safety of a given measurement setup and to identify problems. - to perform simple risk analyses of devices for circulatory and pulmonary medicine.
Course contents	- Fundamentals of fluid mechanics with regard to the flows in the circulation and lungs - Pressure measuring method: Invasive, non-invasive - Flux measurement method: Invasive, non-invasive - ECG: Conclusion, most important pathophysiological Phenomena, derivations, basic circuits - Spirometry, oximetry - Cardiac pacemakers: basics, components, Operating modes - Safety technology in devices and installation with specific aspects of cardiac safety - Applied risk analysis for cardiovascular devices Lung Medicine
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Medical Data Engineering 1

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Inter-semester project (together with the course "Medical Data Engineering 2
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to design software for the health care system which could be used by service facilities of the Health Information Network (GIN, Austrian eCard System, electronic insurance card). - to generate structured data from the medical sector and to process them, similar to the CDA findings from the Austrian health file ELGA, and the eCard services - Design database applications for the health care sector and perform simple database transactions. - to apply the basic rules of scientific work when writing and analysing texts, distinguishing a scientific approach from a non-scientific (everyday) one
Course contents	- Health Information Network (GIN) - Software development for the health sector - Structured data in the health sector
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Safety & Communications in Medical Data Engineering

Degree programme	BBE

Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Principles and methods of software development and software testing
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - To apply standardised methods of software development. - to plan and implement basic software testing tasks. - to implement ISO/IEC 62304, ISO 13485, IEEE 829 from theory into practice. - explain the communication chain of the Continua Health Alliance. - implement a client/server connection using the TCP/IP protocol.
Course contents	- fundamental test process - V-model - Standards for medical software development - Standards for medical software development - Basics of data communication - IDE Features (Debugging, Unit Tests, ...)
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Circuit Design & Signal Analysis

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00

Incoming places	Limited
Course description	This lecture aims to give an introduction to circuit design and to build simple circuits for measuring biosignals. On the other hand the analysis of the self-recorded signals is discussed
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - analyse passive networks for DC and AC input signals. - Dimensioning of a simple amplifier for bioelectric signal. - Design and evaluation of electronic circuits. - graphical description of analog input stages and active filter.
Course contents	- passive electronic components - AC and DC analysis of linear network - Complex signal analysis - ESD protection in the biomedical field - Operational amplifier circuits: Amplifier and Filter circuits - Instrumentation amplifier for bioelectric - Single and dual voltage supplies for analogue/digital circuits - Guidelines for verification of electronic Circuits - Design and evaluation of a biosignal amplifier
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Embedded Systems in Medicine

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Introduction and subsequent project work in the field of "Embedded

	Systems"
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - To name and explain the most important units of embedded systems in medical devices - To define the essential requirements for electronics in medical devices - To name and prototype simple medical devices in their components
Course contents	- project work
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Basics of Circuit Design

Degree programme	BBE
Semester	4
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Introduction to circuit design
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - explain the basics of circuit design - to mention special features of medical devices - Design basic medical device circuits and to realise prototypes
Course contents	- Circuit design - Safety and construction for electronics in medical devices - Circuit design of medically used Electronic Components
Prerequisites	

Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Immunology

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Introduction to Immunology
Teaching methods	Self-study and Team work in class, student-centered learning, presentations of the group works
Learning outcome	After passing this course successfully students are able to ... - explain basic relationships of immunological interactions. - classify the innate and adaptive immune system. - theoretically distinguish bacterial and viral infections. - explain basic mechanisms of allergies and autoimmune diseases - explain the principle and challenges of transplantation.
Course contents	- lymphoid organs and their function - innate and adaptive immune system - viral and bacteriel infection - inflammation reactions - allergy, autoimmune diseases, transplantation
Prerequisites	Knowledge from ANAT, CCT and INSTR about cells and antibodies
Assessment Methods	- 10% active in-class participation (questions and presentation), 15% summary of the Mini-Review (has to be positive), 75% final moodle exam (has to be positive)
Recommended Reading and Material	- K. Murphy and C. Weaver, “Janeway´s Immunobiology,” 9th Edition, New York, NY, Garland Science/Taylor & Francis, 2017
Attendance	75% attendance is compulsory.

Comments

Cancer Drugs & Therapies

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description

This course deals with the differences between normal and tumor cells, how tumor cells can be targeted, how the body acts on drugs, about the relationship between drug concentration and pharmacological effect, and how patient and tumor factors are taken into account in personalized therapy approaches.

Teaching methods

Self-study phases and class units alternate. In self-study, content is developed using literature and with the help of questionnaires, videos and self-checks; in the presence phase, in-depth content is presented, discussed and worked on in group work.

Learning outcome

After passing this course successfully students are able to ...
- Outline the development of tumors on a molecular and cellular level and enumerate the characteristics of tumors described by Hanahan and Weinberg.
- Propose solutions based on bioassays for questions in the field of tumor biology.
- Describe common in vitro and in vivo tumor models and to explain possible applications using examples.
- Explain the categories of pharmacokinetics and essential parameters of pharmacodynamics and outline the essential steps to the production of pharmaceuticals.
- Perform simple calculations with pharmacokinetic parameters (e.g. bioavailability, volume of distribution, clearance).
- Distinguish between acute and chronic toxicity, explain different types of toxic responses and dose-response curves, and give examples of different types of toxins.
- Compare traditional chemotherapy, gene therapy and cell-based treatment options in oncology and to explain the underlying molecular mechanisms of action using selected examples.

Course contents	- Tumor assays - Tumor models - Pharmacokinetics and pharmacodynamics - Toxicology - Traditional cancer drugs - Gene- and cell-based therapies
Prerequisites	Biochemie und MolekularbiologieCell Culture Techniques
Assessment Methods	- Entrance tests, Group work, Final Exam
Recommended Reading and Material	- Kleinsmith: Principles of Cancer Biology, 2014, Pearson
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	

Cell Culture Techniques

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	This course gives an introduction to cell culture techniques.
Teaching methods	Self-study phases and class units alternate. In self-study, content is developed using literature and with the help of questionnaires, videos and self-checks; in the presence phase, in-depth content is presented, discussed and worked on in group work.
Learning outcome	After passing this course successfully students are able to ... - accurately describe the morphology of cells, to explain the origin as well as the advantages and disadvantages of primary and immortalized cells and to compare the requirements of adherent cells and suspension cells. - select suitable media and media additives for the cultivation of mammalian cells, carry out simple calculations to provide the necessary reagents and correctly interpret the course of growth

	curves. - explain standard techniques of aseptic cultivation of eukaryotic cells in detail, to show possibilities for the detection of contamination and to suggest necessary countermeasures. - determine cell counts and to name bioassays routinely used to record cell viability, apoptosis and proliferation and to describe the principles on which these assays are based. - name possible applications for the use of cells in biotechnology, research and medicine (e.g. virology, drug testing, tissue engineering, gene therapy) and to describe them using specific examples.
Course contents	- Biology of various cell types - Equipment, basic methods and reagents in a cell culture laboratory - Types of contamination and their specific detection - Basic calculations in the cell culture lab - Cell culture methods in various fields of application
Prerequisites	Courses: Biochemie und Molekularbiologie, Biochemielabor, Instrumentelle Analytik in der Labormedizin
Assessment Methods	- Entrance tests, Group work, Handout, Final Exam
Recommended Reading and Material	- Freshney's Culture of Animal Cells, Capes Davis & Freshney, 2021, Wiley Blackwell
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	

Cell Culture Laboratory

Degree programme	BBE
Semester	4
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Learning the most important methods and proper use of the equipment used in cell culture

Teaching methods	Independent development of the basics of cell culture techniques, discussion of the course of the laboratory exercise and the experiments, then independent work in cell culture, writing of a laboratory protocol
Learning outcome	After passing this course successfully students are able to ... - To apply standard techniques of culturing eukaryotic cells under aseptic conditions and to recognize possible contamination in good time in order to take the necessary measures. - to use the equipment required for this, taking into account safety regulations, to recognize possible malfunctions in good time and, if possible, to rectify them yourself. - Prepare reagents and media, label containers adequately and dispose of waste in accordance with legal requirements. - carry out simple tests with cells (e.g. mycoplasma test, cytotoxicity test) according to standard instructions. - to describe and evaluate all the work steps carried out and the microscopic images generated in the process in a comprehensible manner in a written protocol and to critically reflect on the knowledge gained. - to apply the basic rules of scientific work when writing and analyzing texts, and to distinguish a scientific approach from a non-scientific (everyday) approach. - Record work steps and results obtained in a laboratory book.
Course contents	- Introduction to cell culture methods of eukaryotic cells (thawing, medium change, passengers, cell counting, freezing) - Training in handling of cell culture relevant laboratory equipment (incubator, laminar flow workbench, centrifuge, microscope) and reagents - Performance of a mycoplasma test and a cytotoxicity test including evaluation
Prerequisites	Biochemie und Molekularbiologie
Assessment Methods	- Test, Protocol
Recommended Reading and Material	- Freshney's Culture of Animal Cells, Capes Davis & Freshney, 2021, Wiley Blackwell
Attendance	There is a compulsory attendance of 100%.
Comments	

Signal Acquisition and Analysis

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course systematically explores biosignals using a mix of theoretical teaching, hands-on lab measurements, and practical implementation of signal processing techniques. The topics are first introduced in self-study units and then deepened during face-to-face sessions. Understanding the material is reinforced and assessed through exercises that cover and combine different aspects of acquiring and analysing biosignals.
Teaching methods	Students begin by studying relevant topics through self-study. The subsequent attendance phases are designed to deepen their understanding of the subjects and assess their knowledge through topic-specific tasks.
Learning outcome	After passing this course successfully students are able to ... - Explain the generation of different biosignals and their properties - Carry out biosignal measurements under safe conditions - Explain selected approaches of digital signal processing (e.g. signal filtering) - Analyse biosignals in the time and frequency domain - Utilize selected machine learning algorithms for biosignal processing - Visualise and interpret signal processing results
Course contents	- Physiologyand Biosignals - Electrodes and Safety Aspects - Basics of Biosignal Processing - Basics of Digital Filters - Neuroscience - Biosignal Acquisition - ECG Processing - Advance Methods of Biosignal Processing
Prerequisites	Anatomy and Physiology, Maths, Electronics, Measurement technology, Matlab basics
Assessment Methods	- Final Exam

	- Presentation - Laboratory Protocol - Signal Procesing Exercises
Recommended Reading and Material	- Kaniusas, E. (2012): Biomedical Signals and Sensors I, Springer-Verlag Berlin Heidelberg - Kaniusas, E. (2015): Biomedical Signals and Sensors II, Springer-Verlag Berlin Heidelberg - Semmlow, J.L. (2004): Biosignal and Biomedical Image Processing: MATLAB Based Applications, Taylor & Francis - S. D. Library (2019) Essential MATLAB for Engineers and Scientists, 7th ed. Cambridge: Elsevier
Attendance	Attendance according to the FHTW statues
Comments	

Human Computer Interaction

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	project work in the field of "human-computer interaction"
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to name and distinguish between biosignals - biosignals in order to create control systems for users enable - Prototypical applications using to design and experimentally build biosignals
Course contents	- Biosignals, their detection and differentiation - Evaluation of biosignals - project work
Prerequisites	
Assessment Methods	
Recommended Reading and Material	

Attendance	
Comments	

Basics of Circuit Design

Degree programme	BBE
Semester	4
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Introduction to circuit design
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - explain the basics of circuit design - to mention special features of medical devices - Design basic medical device circuits and to realise prototypes
Course contents	- Circuit design - Safety and construction for electronics in medical devices - Circuit design of medically used Electronic Components
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Embedded Systems in Medicine

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00

Incoming places	Limited
Course description	Introduction and subsequent project work in the field of "Embedded Systems"
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - To name and explain the most important units of embedded systems in medical devices - To define the essential requirements for electronics in medical devices - To name and prototype simple medical devices in their components
Course contents	- project work
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Rapid Prototyping

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	This course teaches the basics of different rapid prototyping technologies and methods of additive and subtractive manufacturing. In particular, CAD modeling, 3D printing (FDM) and laser cutting are discussed in more detail and deepened by means of practical exercises.
Teaching methods	* Teaching theoretical basics using lecture slides, study letters and literature references* Development of 3D modeling techniques, partly through self-study or distance learning* Use of industry-relevant

	software for design and 3D modeling* Discussion and coordination of design decisions in the group
Learning outcome	After passing this course successfully students are able to ... - Distinguish and name important methods and tools of rapid prototyping - Select and combine 3D models from freely available libraries - Create 3D models using the online CAD software Onshape - Preparing 3D objects for manufacturing using different 3d-printers (slicing) - Create 2D vector graphics for the use of a laser cutter and prepare them accordingly - Explain how devices for additive and subtractive manufacturing work (in particular FDM printers and laser cutters)
Course contents	- Additive and subtractive rapid prototyping methods - Fused deposition modeling (materials, special features of printing and modeling) - Slicing (with Prusa Slicer and BabuLab Studio) - 3D-Drucker Settings (Support Material, Layer Thickness, etc.) - 3D CAD with Onshape (sketching, 3D design, special connecting elements) - 2D vector graphics with Inkscape and Boxes.py - Use of the available 3D printers and the laser cutter
Prerequisites	No special previous knowledge is required
Assessment Methods	- Work tasks in distance learning (development of an online tutorial, creation of a 3D object)
Recommended Reading and Material	- O. Diegel, A. Nordin, D. Motte: A Practical Guide to Design for Additive Manufacturing: Springer Series in Advanced Manufacturing, 2020 - S. Junk, Onshape – Kurz und Bündig: Einstieg in 3D-Druck und CNC-Biegen. Wiesbaden: Springer Fachmedien Wiesbaden, 2020. - (both books are available from the FHTW library as eBooks or as pdf downloads)
Attendance	attendance is obligatory
Comments	

Active Assistive Technologies

Degree programme	BBE
Semester	4

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	

Rehabilitation Engineering

Degree programme	BBE
Semester	4
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	The course provides interdisciplinary knowledge from neurological rehabilitation, clinical practice, therapy concepts, technical basics of diagnostics and the latest scientific findings. The aim is to anticipate the needs of users on the basis of medical principles and apply them to technical applications, planning, therapeutic processes and environmental design.
Teaching methods	Workshops and practical exercises enable students to apply the knowledge they have acquired in real-life situations. This includes, for example, the application of therapy concepts and the practical implementation of therapeutic procedures.Excursions to a rehabilitation center give participants a direct insight into clinical practice. Here they can experience and deepen their theoretical concepts in a real environment.Analyzing case studies enables students to understand complex situations and develop solutions from different perspectives.Collaborative group work promotes interdisciplinary exchange. Students can bring in different perspectives and learn from each other.
Learning outcome	After passing this course successfully students are able to ... - Understand the technical terms of functional movement therapy. - scientifically measure and process therapeutic measures - Recognize and name therapy processes - Anticipate the needs of users on the basis of medical principles - apply therapeutic processes in the design of the environment
Course contents	- neurorehabilitation basics and therapy concepts - rehabilitation - effects of ageing - Cochlear implants: Rehabilitation and aftercare
Prerequisites	non
Assessment Methods	- Moodle test (multiple choice, drag and drop, single choice,

	assignments)
Recommended Reading and Material	
Attendance	The program-wide (BBE) regulations apply.
Comments	

Biomedical Signals and Medical Sensors 1

Degree programme	BBE
Semester	4
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	project work in the field of "Biomedical Signals and Medical Sensors"
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to simulate and design electronic circuits for biosignal processing - to build electronic circuits experimentally and to test and characterise them with modern measuring instruments. - to design prototypes with CAD/CAM tools on the basis of concrete tasks.
Course contents	- project work
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Human Computer Interaction

Degree programme	BBE
Semester	4

Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	project work in the field of "human-computer interaction"
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to name and distinguish between biosignals - biosignals in order to create control systems for users enable - Prototypical applications using to design and experimentally build biosignals
Course contents	- Biosignals, their detection and differentiation - Evaluation of biosignals - project work
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Biomedical Signals and Medical Sensors 1

Degree programme	BBE
Semester	4
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	project work in the field of "Biomedical Signals and Medical Sensors"
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to simulate and design electronic circuits for biosignal processing

	- to build electronic circuits experimentally and to test and characterise them with modern measuring instruments. - to design prototypes with CAD/CAM tools on the basis of concrete tasks.
Course contents	- project work
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Sustainable Environmental and Bioprocess Engineering

Business English

Degree programme	BUB
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course, students will learn some of the most important aspects of business communication in English, as well as the most important processes and activities involved in starting a business. This includes understanding the different types of businesses, how to best market a product, and what ethical and sustainability considerations should be taken into account in the process of starting a business. Students also learn important business communication skills and how to work with reports and business plans, how to understand them, how to use innovative presentation methods to inspire an audience and how to expand their business vocabulary in English.
Teaching methods	Short and medium length 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 ... - •apply a wide range of business vocabulary in English, - •give a PechaKucha presentation in English in which they either present a marketing analysis, a CSR (Corporate Social Responsibility) strategy or a financial analysis of a company of their choice, - •understand and analyse a business plan in English, - •understand how products can be marketed using English, - •apply a wide range of techniques to support communication in international teams and meetings using English, - •present facts and developments effectively using English, - •understand the key principles of business ethics and corporate social responsibility using English
Course contents	- •Business topics (marketing, finance, business plan) in English - •Meetings in English - •ELF ('English as a lingua franca') communication - •CSR (Corporate Social Responsibility) and Business Ethics in English - •Business presentations in English
Prerequisites	Course 'Technical English'
Assessment Methods	- Vocabulary test: 10% - Self-study tasks: 30% - Presentation including assessed presentation plan: 60%
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	none

International Business Engineering

Business English

Degree programme	BIW
Semester	2
Course methods	UE
Language	English

ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students will learn some of the key aspects of business communication in English, as well as the key processes and activities of starting a business. This will include understanding what kind of organization a business should be, how best to market a product, and what ethical and sustainability related considerations should be built into the process of starting a business. Participants will also discover important communication tools in business environments and learn how to work with and understand reports and business plans and how to use innovative presentation methods to engage an audience as well as expanding their range of business vocabulary
Teaching methods	Short and medium length 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 ... - use a wide range of business vocabulary in English - hold a Pechakucha presentation, presenting either a marketing analysis of, a CSR strategy for, or a financial analysis on a company of their choice - understand and deconstruct a business plan - understand how products can be marketed - use a wide variety of techniques to aid communication in international teams and meetings - effectively present data and trends - understand the key principles of Business Ethics and Corporate Social Responsibility (CSR) and apply them to different companies
Course contents	- Business topics (marketing, finance, business plan) - Meetings, ELF communication - CSR and Business Ethics - Business Presentations
Prerequisites	B2 level English, positive grade in Technical English
Assessment Methods	- 10% Vocabulary Test - 30% Self-studies and class preparation and discussion - 60% Business PechaKucha presentation and assessed presentation plan
Recommended Reading	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett

and Material	Verlag - Business Communication for Success (2015, University of Montana) Available at: https://open.umn.edu/opentextbooks/textbooks/8
Attendance	75% mandatory
Comments	None

Applied Computer Science

Degree programme	BIW
Semester	4
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 - Collections - Functions - File-Handling - Regular Expressions - Application Bundeling - Raspberry Pi - M2M-communication - Open Data
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	
Comments	75%

Engineering Management

Degree programme	BIW
Semester	6
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This module teaches the knowledge and skills that are required in practice today in the job description of an "industrial engineer". In this module, students will familiarise themselves with selected process models of product development and the transition to production. In some of the focal points presented, in-depth knowledge of the respective technology is consolidated. These will be clearly explained using reference examples and developed in the context of practical tasks.
Teaching methods	Integrative lecture, calculation and group exercises
Learning outcome	After passing this course successfully students are able to ... - to present the technical requirements of the job description of the industrial engineer in practice. - to evaluate and classify problems that predominate in practice. - Applying methodological knowledge in a problem-solving manner in practice. - Explain and apply procedural models for interdisciplinary system development (especially the 3-layer V-model). - Understand the complexity of the interaction between mechanical-electronic software and project management. - to break down, develop and manufacture a complex system into subsystems with the help of the acquired methodological

	competence.
Course contents	- Basic terms and historical development in industrial engineering - The job description of the industrial engineer - Industrial engineering in the product development process and product life cycle - System and method competence to develop an individual problem-solving competence in IE - Digital Twins, Virtual Comissioning - Virtual Engineering - Safety design, risk analysis
Prerequisites	Production Technology, Management Basics 1 und 2
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Weilkiens T.: Systems Engineering with SysML/UML., 2006 - Douglas B.P.: Agile Systems Engineering., 2016 - Bokranz, R.; Landau K.: Handbuch Industrial Engineering: Produktivitätsmanagement mit MTM, Schäfer Pöschel, Auflage: 2, 2012 - Sihn, W.; Sunk, A.; Nemeth, T.; Kuhlang, P.; Matyas, K.: Produktion und Qualität –Organisation, Management und Prozesse; Carl Hanser Verlag, 2016
Attendance	Attendence is mandatory according to university standards
Comments	none

Master DEGREE PROGRAMS

Renewable Energies

Marketing and Supply

Degree programme	MEE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	In this sub-module students acquire basic skills in the areas of marketing and sales.
Teaching methods	Flipped Classroom
Learning outcome	After passing this course successfully students are able to ... - define the terms “market” and “marketing” - name the components of a marketing plan - Differentiate between different types of marketing strategies - differentiate between different market research methods - prepare product policy decisions - prepare price policy decisions - prepare communication policy decisions - prepare sales policy decisions - weigh up between different alternatives regarding the organizational anchoring of marketing in the company - calculate key figures for effectiveness and efficiency controls in marketing - name various instruments of online marketing and to describe their mode of operation
Course contents	- Concept and characteristics of marketing - Marketing planning - Marketing strategies - Market research - Product policy - Price policy - Sales policy

	- Marketing organization - Marketing controlling - Online marketing
Prerequisites	Fundamentals of business administration
Assessment Methods	- Written final exam: 70 points - Development of a marketing concept (group work): 30 points
Recommended Reading and Material	- Bruhn, Marketing, Springer-Verlag - Bruhn, Marketingübungen, Springer-Verlag
Attendance	See examinations regulations
Comments	

Advanced Modelling and Simulation

Degree programme	MEE
Semester	2
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	Modeling, simulation and optimization of specific energy systems: On the basis of project work, technical energy systems such as a PV or wind power system, a building energy system, a district anergy network or an energy community are modeled, simulated and optimized. The focus is on the application of the theoretical principles and methods imparted in MEE1-4 to examples from everyday energy technology. Students can choose from one of four energy technology projects: BIPV, Buildings, Plus Energy Quarter and Energy Community, program a model of the system in appropriate languages and tools such as Matlab, Python, TRNSYS, PowerFactory and use it to carry out simulations and optimizations. The focus is on the application of simulation technology and programming. The content-related consideration and analysis of the exemplary systems will be deepened in the further course of the curriculum.
Teaching methods	Project work with Q&A and presentation of the project progress in face-to-face and distance learning for the independent creation of the models, implementation of the simulation and documentation in the

	form of a project report
Learning outcome	After passing this course successfully students are able to ... - To model and simulate more complex energy systems - To produce, test and use the necessary code - Perform optimizations for an energy system - Combine several individual models to form a larger overall model - To assess and name the applicability, strengths and challenges of typical energy system models - Explain the code involved and find and fix bugs in it
Course contents	- Students choose a project of a typical energy system: - - Building energy systems (PV simulation, Building thermal model) - - Positive energy Districts (Integrated models, District energy networks) - - Energy community systems (PV, Emobility, Storage) - - Building Integrated PV systems (Electrotechnical Systems)
Prerequisites	MEE1-4 Introduction to Modelling and Simulation
Assessment Methods	- 30% intermediate presentation of the exercises (teamwork) halfway through the course - 70% final presentation of the exercise results at the end of the course (open book) with an integrated examination discussion on understanding and theory. The students present their executable model and answer questions about its function and structure. The focus of the performance assesment is on the handling of the model. Students should be able to explain how the modeling and simulation can be implemented
Recommended Reading and Material	- Nollau, R., 2009. Modellierung und Simulation technischer Systeme: Eine praxisnahe Einführung. Springer-Verlag, Berlin Heidelberg. https://doi.org/10.1007/978-3-540-89121-5 - Crastan, V., 2004. Modellierung und Simulation, in: Crastan, V. (Ed.), Elektrische Energieversorgung 2: Energie- und Elektrizitätswirtschaft, Kraftwerktechnik, alternative Stromerzeugung, Dynamik, Regelung und Stabilität, Betriebsplanung und -führung. Springer, Berlin, Heidelberg, pp. 367–412. https://doi.org/10.1007/978-3-662-06958-5_10
Attendance	Mix of classroom and distance learning (50-50)
Comments	

Applied Topic-Specific Methods

Degree programme	MEE
Semester	2
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

Based on the work done in the course 'Specialization Focus Definition and Scientific Methods', students work in small groups to work on energy concepts, e.g. for energy communities, plus-energy districts, or regional/local energy systems, also modeling this (i.e. in Matlab or Python) and carry out a simulation or optimization of selected scenarios in order to acquire topic specific methods for further use in their specialization field

Teaching methods

Independent project work with Q&A and presentation of the project progress in attendance and self-study for the independent development, modeling and simulation/optimization of energy concepts for energy systems; final documentation in the form of a project report, taking into account the formal (e.g. linguistic implementation,...) and content requirements (e.g. quality of own contribution,...)

Learning outcome

After passing this course successfully students are able to ...
- develop and model energy concepts in a sophisticated manner
- develop and simulate or optimize various scenarios
- understand and classify the results of the simulation or optimization and interpret them in a wider context
- write up the results of the project work, taking into account the formal (e.g. linguistic implementation,...) and content-related requirements (e.g. quality of their own contribution,...)
- carry out an interdisciplinary complex project in a group work
- apply project management in complex projects according to the situation

Course contents

- Development of scenarios
- Deepening the content of the selected topic area
- Carrying out a sensitivity analysis
- Definition of key performance indicators
- Modelling, simulation / optimisation of complex systems
- Analysis and interpretation of simulation and optimisation results
- Application of agile project management methods

Prerequisites	Introduction into Modeling and Simulation
Assessment Methods	- First Draft (max 15pts) - Second draft (max 30 pts) - Presentation (max 15 pts) - Final report (max 40 pts)
Recommended Reading and Material	
Attendance	
Comments	

Energy Economics

Degree programme	MEE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The course provides a clear understanding of the principles of energy economics. Function and Objectives of energy economics on the national, international and global level are discussed, in particular concerning to climate change and energy security. Focus is on the application of economic assessment methods, that will be explained in the course and applied.
Teaching methods	The content will be developed in the lectures and deepened as part of distance learning. The method for economic calculation is trained via group work in distance learning units and exercises and the results of the group work are presented at the end of the semester
Learning outcome	After passing this course successfully students are able to ... - describe and apply economic assessment methods and to compare different energy technologies from an economic perspective - interpret and analyze energy balances - describe and explain the processes on energy markets - name and explain energy policy instruments and analyze their effects - name and analyze the magnitude of energy consumption and volume in Austria, Europe and worldwide and describe the

	challenges for energy policy
Course contents	- Foundations of energy economics - Energy statistics - Energy prices and energy markets - Greenhousegas-Emissions and climate change policies - Instruments of energy policy - economic assessment methods, e.g. cost-benefit analysis for different energy technologies - Balancing technically and economically - Basics of the liberalized energy markets - Organization of the Austrian energy markets - Energy consumption and supply, institutional setting
Prerequisites	
Assessment Methods	- end exam
Recommended Reading and Material	- Georg Erdmann/Peter Zweifel: Energieökonomik - Theorie und Anwendungen - Kaltschmitt: Regenerative Energien in Österreich
Attendance	75%
Comments	

Assessment Methods

Degree programme	MEE
Semester	2
Course methods	PRJ
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The course provides comprehensive insight technology assessment methods on societal, ecological, and economic levels and presents handling of software tools for material flow analysis to assess environmental impacts of energy systems. In course of a semester project students train heuristic methods, literature reviews and work in research groups.
Teaching methods	Lecture units (distance learning) to convey the methodological and content-related basics • Exercises to teach the necessary

	methodological skills (including the software tool GEMIS) • Group work • Plenary discussions and presentations
Learning outcome	After passing this course successfully students are able to ... - describe technology assessment methods (qualitative and quantitative) - apply scenario method (cross-impact analysis, sustainability assessment) - handle the LCA software GEMIS - discuss systemically and analyse teh developments in the energy system - choose adequate methods to answer different sicentific questions
Course contents	- Introduction to technology assessment methods - Introduction to quantitative and qualitative scenario methods (cross-impact analysis, sustainability assessment) - Heuristic methods and literature research - Material flow analysis in the open-source software tool GEMIS
Prerequisites	module “Energy, Environment and Society”
Assessment Methods	- 30% opne-book group work at the end of the course - 70% different exercises for each of the course parts (GEMIS, economic methods, first interim report, second interim report, presentation, final report)
Recommended Reading and Material	- Rohpohl, G., 1999, Innovative Technikbewertung. Hgs.; Bröchler, S., Simonis, G., Sundermann, K., Handbuch Technikfolgenabschätzung. edition Sigma, Berlin - Sundermann, K., Constructive Technology Assessment. Hgs.; Bröchler, S., Simonis, G., Sundermann, K., Handbuch Technikfolgenabschätzung. edition Sigma, Berlin - Vester, F., 1987, Der Papiercomputer. Management Wissen, Band 10, Nummer; 48–57 - Kreibich, R., Oertel, B., Wölk, M., 2011, Futures studies and future-oriented technology analysis principles, methodology and research questions. in: 1st Berlin symposium on internet and society.
Attendance	Attendance required
Comments	In both courses, interdisciplinary approaches to highly topical energy-related subject areas are taught. The methodological and content-related examination of both the creation of energy concepts on the building side and their implications for the overall system as well as the development of scenarios and their sustainability assessment are taught comprehensively within the framework of semester projects.

Energy Planning

Degree programme	MEE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	The course focuses the targeted development of (supra-)national, regional, municipal and neighbourhood-related energy systems through energy concepts. Following input on the social and technical aspects of energy concepts, selected real-world examples will be used to critically discuss whether and how energy concepts can contribute to climate-neutral development, for example by increasing energy efficiency and flexibility, utilising renewable energy sources or sector coupling.
Teaching methods	Lecture units to convey the methodological and content-related basics • Project reports and presentations in the plenum
Learning outcome	After passing this course successfully students are able to ... - explain approaches for elaborating and evaluating energy concepts on different scales - critically analyse and reflect the relationships between actors, their targets, and the use of renewable energy technologies - identify appropriate use of renewable energy technologies in different reference areas and social environments - explain and self-determinedly evaluate typical structures, processes, strengths, weaknesses, and challenges of energy concepts on different scales - assess the relevance of energy concepts for global and local climate targets - explain interactions between energy and settlement systems - adapt the use of renewable energy technologies to different reference areas and social environments
Course contents	- From energy system to energy concept - Typology of energy concepts - Procedure for the creation of energy concepts - Case studies of innovative energy concepts - Critical evaluation and, if necessary, further development of an

	existing energy concept
Prerequisites	None
Assessment Methods	- 20% Participation - 40% Case study - 40% Presentation
Recommended Reading and Material	- Albers, G. und Wékel, J.: Stadtplanung. Eine illustrierte Einführung. Primus Verlag, 2. Auflage 2011, - Handbuch für kommunale und regionale Energieplanung – HANDBUCH KREP 2000. Graz: Joanneum Research Forschungsgesellschaft mbH, 2001, - ISO 15686-5 Buildings and constructed assets – Service Life Planning – Part 5: Buildings and constructed assets -- Service life planning -- Part 5: Whole life costing (2008), - Kaltschmitt, M.; Streicher, W. (Hrsg): Regenerative Energien in Österreich. Vieweg+Teubner, Wiesbaden: 2009, - ROK: Energie- und Raumentwicklung – Räumliche Potenziale erneuerbarer Energieträger. Schriftenreihe Nr. 178, März 2009, - POST-OIL CITY. Institut für Auslandsbeziehungen e.V. in Kooperation mit ARCH+ Zeitschrift für Architektur und Städtebau 2011, - Petersdorff, C.; Everding D.; Wouters, F.: Solarer Städtebau – ein Weg zur Nachhaltigkeit. O.J., Ecofys GmbH - www.ecofys.de, - Reicher, C.: Städtebauliches Entwerfen. Vieweg+Teubner Verlag, 2012, - VDI 3807 Energie- und Wasserverbrauchskennwerte für Gebäude. Teilkennwerte elektrische Energie. Blatt 4, 2008, - Magistrat der Stadt Wien: Smart City Wien Rahmenstrategie. Wien: 2019 - Magistrat der Stadt Wien: Energieraumplanung. Werkstattbericht 182, Wien: 2019
Attendance	compulsory on certain dates
Comments	

Digital Systems in Energy Industry

Degree programme	MEE
Semester	2
Course methods	ILV
Language	English

ECTS Credits	5.00
Incoming places	Limited
Course description	The course "Digital Systems in the Energy Industry" deals with the increasing digitization in the energy industry and offers an overview of relevant digital technologies in this context. The subjects covered are data acquisition and processing, data management and analysis, forecasts, digital processes and business models, automation, self-learning systems, Internet of Energy, digital twins and data protection.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - demonstrate proficiency in data acquisition and processing techniques - apply data management and analysis methods to extract meaningful insights from datasets - develop accurate forecasts based on data analysis and predictive modeling - understand and implement digital processes and business models in various industries - implement automation techniques to streamline processes and increase efficiency - design and implement self-learning systems for continuous improvement and adaptation - analyze and utilize the Internet of Energy concepts for efficient energy management. - utilize Digital Twins for virtual representation and analysis of physical assets or systems - implement data protection measures to ensure the security and privacy of sensitive information
Course contents	- data acquisition and processing - data management and analysis - forecasts - digital processes and business models - automation - self-learning systems - Internet of Energy - digital twins - data protection
Prerequisites	

Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Medical Engineering & eHealth

Writing the Master´s Thesis

Degree programme	MME
Semester	4
Course methods	SO
Language	English
ECTS Credits	28.00
Incoming places	Limited
Course description	Writing the master's thesis according to scientific principles.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - narrow down a complex and practice-relevant topic with the help of scientific questions - work on a complex and practice-relevant topic with the help of scientific methods - adequately argue the selection of the scientific method - adequately document, validate and discuss the solution obtained
Course contents	- Creation of a master's thesis - Use of scientific methods - Developing research questions - Scientific work - Scientific writing
Prerequisites	
Assessment Methods	- Assessment of the Master's thesis according to UASTW guidelines
Recommended Reading and Material	
Attendance	

Comments

Biomechanics for Medicine

Degree programme	MME
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course provides an introduction to mechanics and biomechanics, followed by the application of biomechanical theory. Biomechanical multibody simulation software is utilized to analyze the biomechanics of various sports through practical examples, including finite element methods (FEM).
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Advanced / Applied Optics

Degree programme	MME
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	The course covers the fundamentals and applications of advanced optical concepts, including geometric optics, microscopy techniques, and spectroscopy. Emphasis is placed on their implementation in medical devices and healthcare applications, providing insights into the optical principles behind diagnostic and therapeutic tools.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Study Design and Biostatistics

Degree programme	MME
Semester	2
Course methods	SE
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	The course covers mathematical methods in non-parametric statistics, focusing on their application in experiment and study design. It includes the processes of data collection, organization, summarization, presentation, and analysis, followed by interpretation and drawing conclusions from the data sets.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading	

and Material

Attendance

Comments

Self Management

Degree programme	MME
Semester	2
Course methods	SE
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	This course focuses on personal development within the context of the healthcare ecosystem. Students will explore their current standing, future goals, and leadership roles within this environment. It includes reflections on learning from the PRT course and framing the Master's thesis as an opportunity for personal growth. The course also integrates skills from the Scientific Publishing course and includes a lecture series and workshop format. The emphasis is on managing oneself effectively within the broader healthcare ecosystem.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

EU Law and Regulations

Degree programme	MME
Semester	2

Course methods	SE
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The course provides an overview of the structure and institutions of the European Union, with a focus on the European Court of Justice (ECJ) and case-solving methods. Additionally, it covers the Medical Device Regulation (MDR), addressing its application in development and use of medical devices.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Informatics of Biological Systems

Degree programme	MME
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course explores modern computational methods essential for analyzing and studying biological systems. Focus is placed on computer-aided techniques demonstrated through biomedical examples, highlighting their application in contemporary research and problem-solving.
Teaching methods	

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

Artificial Intelligence in Medicine

Degree programme	MME
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course explores five key methodologies in AI: connectionism (neural networks), symbolism (logic-based systems), evolutionism (biologically inspired algorithms), Bayesian methods (probabilistic modeling), and analogizing (pattern matching for recommendations). Ethical implications and responsible AI use are also discussed.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Processes for Medical Device and System Design

Degree programme	MME
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course covers key processes and steps involved in implementing quality management systems for the design, development, and market introduction of medical devices. It emphasizes the practical aspects of addressing regulatory requirements and provides a structured approach to ensuring compliance throughout the development process and the complete product life cycle.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Introduction to MATLAB for Applications in Life Sciences

Degree programme	MME
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	This course freely follows the previous introduction to MATLAB for

	Applications in Life Sciences (MLS1) and furthermore deepens the foundations of selected chapters from the field of life sciences. At the end of the course, students should be able to use MATLAB in their own work for purposes of processing presented signals/biosignals. The course consists of interactive lectures with students solving sample MATLAB problems ranging in difficulty. Individual topics can be introduced into the course setup.
Teaching methods	Interactive lectures about selected topics from the field of Life Sciences, Practical solution of assignments by students supported by lecturer, Project consultations
Learning outcome	After passing this course successfully students are able to ... - Use MATLAB for data manipulation and visualization - Generate signals and perform basic signal operations in MATLAB - Create and use basic digital filters to process signals in MATLAB - Apply gained knowledge and techniques to analyse specific biomedical signals (ECG/EMG etc.)
Course contents	- Signals classification and properties - Operations with signals and signal generation - Design of digital filters - Biosignal analysis
Prerequisites	Basic programming knowledge, General knowledge from Life Sciences on bachelor level
Assessment Methods	- Activity during lectures
Recommended Reading and Material	- V.K. Ingle and J. G. Proakis, Digital Signal Processing Using MATLAB, 1st ed. Pacific Grove, USA: Brooks/Cole Pub. Co., 1999 - A. B. Biran, What Every Engineer Should Know About Matlab and Simulink. New York: Taylor & Francis Group, 2010.
Attendance	Attendance is mandatory, only 20% of absence is tolerated
Comments	

Scientific Publishing

Degree programme	MME
Semester	2
Course methods	SE
Language	English
ECTS Credits	3.00

Incoming places	Limited
Course description	The course provides an introduction to the essentials of scientific publishing, including writing strategies, finding relevant literature, and navigating the publishing process. It also covers key aspects of participating in scientific conferences. The course complements the PRT and Self Management courses.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

eHealth

Degree programme	MME
Semester	2
Course methods	SE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course explores the concept of eHealth, examining existing applications and the requirements for implementation across legal, IT, medical, and economic dimensions. Students will learn how to evaluate eHealth applications, including cost-benefit analysis. The course incorporates perspectives from various stakeholders—politicians, patients, economists, industry, and medical experts—using a Problem-Based Learning (PBL) approach. An additional business role-playing game will help students experience these different viewpoints firsthand.
Teaching methods	

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

Software Engineering

Modern Web/Frontend Framework

Degree programme	MSE
Semester	4
Course methods	ILV, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited. **This is an elective subject and will only take place if there are enough registrations.**
Course description	An introduction to web development with a focus on the Svelte Framework.While the focus is on Svelte, many topics covered here will be of use for the wider area of web development and can be used in other frameworks.
Teaching methods	Remote via Zoom
Learning outcome	After passing this course successfully students are able to ... - Build their own websites and web-apps
Course contents	- An overview of the web development ecosystem - The Svelte framework for building User interfaces - The SvelteKit framework for building data-driven web applications - State management and data-driven architecture - HTML Forms - Providing and consuming REST-based APIs - Data Storage options - Deployment options

	- Authentication - UI Design with CSS and Tailwind - Alternatives to WebApps (PWA, Desktop apps, Mobile apps) using Svelte
Prerequisites	Basic knowledge about HTML, CSS, Javascript, databases and REST APIs.
Assessment Methods	- Students will be creating their own web app to show their learning success
Recommended Reading and Material	- https://svelte.dev - https://kit.svelte.dev
Attendance	
Comments	

User Experience Evaluation

Degree programme	MSE
Semester	4
Course methods	ILV, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This course teaches evaluation methods and challenges regarding usability and user experience measurement. Subjective experiences can be quantified and objectively measured using metrics and statistical methods.
Teaching methods	Practical exercises and examples, discussions, group work, lectures
Learning outcome	After passing this course successfully students are able to ... - apply statistical methods correctly to compare various metrics (time on task, task success) - apply these methods in a project environment - name various UX metrics as well as their categories, collect metrics, analyse and interpret them - analyse results (e.g. significance) and present them appropriately
Course contents	- UX metrics - suitable statistical methods - data visualization

	- reproducibility of tests
Prerequisites	Basics of user centered designs and software usability
Assessment Methods	- Course immanent assessment method and/ or end exam
Recommended Reading and Material	- Tullis, Thomas / Albert, William. (2008) Measuring the User Experience : Collecting, Analyzing, and Presenting Usability Metrics, Morgan Kaufmann, ISBN-13: 978-0123735584 - Sauro, Jeff. (2012) Quantifying the User Experience : Practical Statistics for User Research, Morgan Kaufmann, ISBN-13: 978-0123849687 - Bortz, Jürgen / Lienert, Gustav A. (2003) Kurzgefasste Statistik für die klinische Forschung : Leitfaden für die verteilungsfreie Analyse kleiner Stichproben, Springer, ISBN-13: 978-3540757375
Attendance	
Comments	

Artificial Intelligence and Visual Computing

Degree programme	MSE
Semester	4
Course methods	ILV, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited

Mobility Data Analysis

Degree programme	MSE
Semester	4
Course methods	ILV, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited. **(This is an elective subject and will only take place if there are enough registrations)**
Course description	The goal of the course is to introduce the students the main concepts

	related to mobility data analysis (MDA), using MobilityDB, a mobility database implemented over PostgreSQLand PostGIS.The first (online face-to-face) part of the course will introduce the context for Mobility Data Science. We start with an overview of temporal and spatial databases, and then we introduce the concept of Moving Objects databases. Following the classic Güting-Schneider book, we present an abstract model and then two discrete modelsbased on slicing and sequencing. Then we move into a concrete implementation of the discrete model, MobilityDB (https://mobilitydb.com/). We describe thesystem in detail using three cases studies: maritime navigational data (AIS),flight data (OpenSky) and car tfaffic data (BerlinMOD benchmark). The second part of the course consists in a project to be developed offline.
Teaching methods	Lectures and assignments where theory is applied.
Learning outcome	After passing this course successfully students are able to ... - Create a mobility database - Analyze continuous mobility data - Use techniques to visualize mobility data using Geographic Information Systems
Course contents	- Introduction and motivation. Why do we need mobility databases? Why spatial DBs are not enough? Example cases. - Fundamentals of mobility databases. Basic concepts. The property graph data model. Spatial databases, temporal databases Spatiotemporal databases. - Querying the history of movement: The Abstract Model. The ADT approach. Spatial, temporal and non-temporal data types. Spatio-temporal predicates. - The Discrete Model. Problems of the discrete model. Spatial, temporal and non-temporal types in the discrete model Sliced and sequence representations: pros and cons. Implementation of the discrete model. - Indexing Spatial and spatio-temporal indexes R-trees and R+-trees, Kd-trees, PR-quadtrees - Implementation of MobilityDB Data model. Using MobilityDB for mobility analysis. Applications to different domains: ships, public transport analysis, car movement, etc.
Prerequisites	Good knowledge of relational databases and SQL
Assessment Methods	- Short midterm evaluation at the end of the online part - Course project
Recommended Reading	- Ralf Hartmut Güting, Markus Schneider. Moving Objects

and Material	Databases. . Morgan Kaufmann 2005, ISBN 0-12-088799-1. - Chiara Renso, Stefano Spaccapietra, Esteban Zim´anyi. Mobility Data: Modeling, Management, and Understanding. Cambridge University Press 2013, ISBN 978-1- 107-02171-6. - Esteban Zimányi, Mahmoud Attia Sakr, Arthur Lesuisse. MobilityDB: A Mobility Database Based on PostgreSQL and PostGIS. In ACM Trans. Database Syst., 45(4): 19:1-19:42, 2020. - Juan Godfrid, Pablo Radnic, Alejandro A. Vaisman, Esteban Zim´anyi. Analyzing public transport in the city of Buenos Aires with MobilityDB. Public Transport., 14(2): 287-321, 2022.
Attendance	Attendance to the online lectures is mandatory, 80% at the minimum.
Comments	We remark that we assume a good knowledge of databases. Students must know how to load data into a database and manipulate and query such data.

Application or use cases of various design patterns (software design)

Degree programme	MSE
Semester	4
Course methods	ILV, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited. **This is an elective subject and will only take place if there are enough registrations**

Software Produktmanagement

Degree programme	MSE
Semester	4
Course methods	ILV, FL
Language	English
ECTS Credits	3.00
Incoming places	Limited. **This is an elective subject and will only take place if there are enough registrations**
Course description	In this module, the students learn how to build and manage Digital Products on three levels: starting with the Strategy and going through

	Roadmap (Planning) into Execution (Implementation). The students will understand the role of a Product Manager/Owner and learn methods and frameworks to work in an agile, customer-centric and data-driven way.
Teaching methods	Lecture, Practical Examples & Cases, Discussion, Group Activities, E-Learning.
Learning outcome	After passing this course successfully students are able to ... - Understand the difference between a Product and a Project, as well as the role of the Product Manager/Owner - Think iteratively in order to build products in an agile way - Define a Product Strategy with a unique and customer-centric value proposition; and a North Star Metric to track its success - Translate that value proposition into a Roadmap, develop it further with product discovery sources, and organise it with objective prioritisation frameworks - Define product features, write their user stories, and design outcome-driven A/B tests for their launch - Manage stakeholders and get leadership buy-in when building digital products - Understand the impact of digital products in society, and identify if a product is built ethically - Help a product scale through Product Growth levers
Course contents	- Principles of Product Management; Role of Product Manager/Owner - Agile, Iterative ways of working - Product Strategy - Product-Market Fit - Competitor Analysis with KANO Model - KPIs, OKRs and North Star Metric - Product Roadmap - Prioritization Methods - User Feedback and Sources of Product Discovery - Feature Definition: User Stories, Acceptance Criteria; Product Requirements Document (PRD) - Experimentation and Analytics: Product Metrics, A/B Testing, Output vs. Outcome - Soft Skills for Product Managers - Impact & Ethics in Digital Products - Product Growth
Prerequisites	Basic knowledge of Business Administration and/or Software

	Engineering.
Assessment Methods	- Development and presentation of group activities in each session (100%)
Recommended Reading and Material	- Cagan, M. (2017). Inspired: How to Create Tech Products Customers Love. - Eyal, N. (2014). Hooked: How to Build Habit-Forming Products.
Attendance	75%
Comments	Further information, resources and materials will be provided via the Moodle course.

Information Systems Management

System Integration

Degree programme	MWI
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	All the different applications of a company‘s IT environment need to communicate with other systems. The course Systems Integration focuses on the fundamentals and most important concepts to improve communication between IT systems on each level to help you to plan and develop value-adding integration solutions. The objective is to get to know the most important concepts for Enterprise Application Integration (EAI). Microsoft BizTalk Server serves as an example of how Microsoft implemented these patterns and principles. Practical exercises will give the possibility to gain some experience in developing system integration solutions.
Teaching methods	SATs, practical exercises, preparation and presentation of a related topic as part of the group project
Learning outcome	After passing this course successfully students are able to ... - reproduce the context, advantages and disadvantages of basic messaging principles and common data formats (flat files and XML) in terms of connecting IT systems. - reproduce and explain the most important enterprise application

	integration patterns. - explain the purpose of transactions and their use as atomic or long-running transactions within enterprise application integration solutions. - reproduce and evaluate the advantages and disadvantages of enterprise application integration patterns to develop a suitable integration software design. - analyse and to make use of the different roles and environments needed as part of the software development process. - apply the basic principles of web services to implement a service solution. - develop an enterprise application integration solution by using Microsoft BizTalk Server as messaging middleware.
Course contents	- Message based communication - Web services - Enterprise application integration - Reliability and environments - Message broker - Content-based routing - Business process modeling - Transactions
Prerequisites	
Assessment Methods	- SATs - 10% - Practical exercises - 30% - Group project - 30% - Final Exam - 30%
Recommended Reading and Material	- Course book - VMware image including a complete Microsoft BizTalk Installation
Attendance	Mandatory
Comments	

Ecotoxicology & Environmental Management

Environmental Analysis

Degree programme	MUT
Semester	2
Course methods	UE
Language	English

ECTS Credits	2.00
Incoming places	Limited
Course description	Environmental analytics teaches methods for the qualitative and quantitative determination of substances in the environment. In this ILV, the theoretical basics of the accompanying exercises are learned.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - provide an overview of the methods of environmental analytics. - know the advantages and disadvantages of different analysis methods. - to explain the principle, implementation and evaluation of frequently used environmental analysis methods and to qualitatively and quantitatively evaluate examples.
Course contents	- Calibration & Validation - Modern water and soil analysis - Principle of chromatography (thin-layer, HPLC, LC, IC, GC) - UV/VIS spectroscopy - IR spectroscopy - Mass spectroscopy
Prerequisites	Applied chemistry, ecological chemistry
Assessment Methods	- Written module exam
Recommended Reading and Material	- Scripts of the lecturers
Attendance	Attendance of at least 75% is mandatory; if more than 25% of the units are missed, the first attempt at the examination will be lost
Comments	

Environmental Analysis Lab

Degree programme	MUT
Semester	2
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	Independent development of laboratory examples
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to determine the quality of a water samples through the application of defined chemical tests - Water sampling according to ISO 5667-12 & ÖNORM 5667-6 and water analysis and testing for microbiological parameters - examine soil samples chromatographically for their substances and to determine their ion exchange capacity. - document final results (protocol with IMRAD structure or according to EU guidelines), analyze and interpret them - classify the chemical waste generated in the laboratory and to dispose it correctly under safety aspects, as well as to independently calculate defined stoichiometric quantities (substance quantities, substance concentration, mass concentrations and pH) and to produce solutions under guidance.
Course contents	- Safety in the laboratory - Photometry - Chemical characterization of water and soil samples - Chromatography (thin-layer, HPLC, IC) - Water sampling, water analysis and microbiological examination of water samples - Basics of cell culture - Writing protocols - Handling chemical waste
Prerequisites	Basics in chemistry, ecology, ecological chemistry
Assessment Methods	- Lab protocols, written module exam
Recommended Reading and Material	- Scripts of the lecturers
Attendance	Full attendance is desired; if missed, an alternative appointment or alternative work may be possible, a maximum of 25% may be missed
Comments	

Applied Ecotoxicology

Degree programme	MUT
Semester	2

Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course, students learn about ecotoxicological test systems at different trophic levels and important parameters for describing the effect of a substance on the environment, including important properties.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - name test organisms for eco-toxicity testing according to the trophic levels in ecosystems - evaluate and assess a given substance (chemicals, biocides) according to its persistence, bioaccumulation and toxicity (especially according to REACH). - use physical-chemical parameters of a substance to predict the fate and distribution of the substance in the environment (also using computer-aided models). - name substances in the nano range and their areas of application and possible effects on the environment.
Course contents	- Ecotoxicological test organisms - Nanotechnology - Analysis of "nanos" in the environment - PBT (persistent, bioaccumulating toxic) - POPs (persistent organic pollutants)
Prerequisites	Chemistry, molecular biology, introduction to ecotoxicology
Assessment Methods	- LV-Immanent assessment, module exam
Recommended Reading and Material	- Newman, M. (2014): Fundamentals of Ecotoxicology, Taylor & Francis Inc.
Attendance	Attendance of at least 75% is mandatory. If more than 25% of the units are missed, the first attempt at the examination will be lost
Comments	

Ecotoxicity Tests

Degree programme	MUT

Semester	2
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this laboratory course, students learn practical handling of selected ecotoxicity tests and biodiversity analysis tests.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - choose the right test system for a given question. - write test reports according to the IMRAD structure. - carry out ecotoxicity tests. - to evaluate the effect of pollutants.
Course contents	
Prerequisites	Ecotoxicological test systems
Assessment Methods	- Course immanent performance assessment, protocols, group discussion, module examination
Recommended Reading and Material	
Attendance	Full attendance is desired; if missed, an alternative appointment or alternative work may be possible, a maximum of 25% may be missed
Comments	

Epigenetics

Degree programme	MUT
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The fundamentals of epigenetics, and the role of genome & epigenome, are presented and considered in context of their

	ecological impacts. Biochemical methods to study epigenetic modifications oft the genome are discussed. Current results from literature on these topics will be presented by students and then discussed and evaluated in the group.Lectures, group discussions of central topics, presentations by the students.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe epigenetic processes in a cell. - understand the relationship between the genome and the environment at the epigenetic level. - explain biochemical methods to study epigenetic processes.
Course contents	- Introduction to epigenetics - DNA sequencing technologies for studying epigenetics - Epigenetic effects & effects of environmental factors - Epigenetic effects & effects of environmental factors - Artificial Intelligence & Machine Learning as novel and powerful resources to analyse and decipher epigenomic data
Prerequisites	
Assessment Methods	- Moodle quiz - Oral presentation - Written module exam
Recommended Reading and Material	
Attendance	Attendance of at least 75% is mandatory, if more than 25% of the units are missed, the first exam entry will be lost.
Comments	

Cell Biology and Alternatives to Animal Testing

Degree programme	MUT
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In ecotoxicological risk assessment exist a number of standardized

tests that include model organisms (animals) as well as in vitro and in silico models. However, when using animals, conflicts arise: a balance must be struck between the assumed gain in knowledge for the benefit of humans and their environment on the one hand and the burden on animals on the other. This course therefore adresses the problem of using animals and legal aspects are discussed. Furthermore, possibilities for alternatives are introduced, such as in vitro cell culture systems. In order to understand this, students gain detailed knowledge of the molecular biological and (cellular) biological processes in eukaryotic cells. Finally, students can apply what they have learned in a practical laboratory exercise.

Teaching methods

Learning outcome

After passing this course successfully students are able to ...
- Give and describe examples of alternatives to animal testing (focus on in vitro and in silico methods).
- To provide an overview of relevant legal aspects.
- Explain the 3R (reduce, replace, refine) strategy.
- Understand basic biological processes of eukaryotic cells (replication, gene expression, DNA repair, etc.).
- Work with in vitro cell culture systems.
- Conduct standard in vitro cell culture tests to monitor viability and/or cytotoxicity.
- Analyse and reflect on own obtained data as well as combine the data with findings from published and relevant scientific studies.
- Integrate the acquired knowledge into concepts of ecotoxicology.

Course contents

- Legal Aspects and 3R strategy
- Overview of animal model organisms (in vivo) and alternatives (in vitro and in silico)
- Molecular biology principles 1 – gene expression
- Molecular biology principles 2 – cell cycle and apoptosis
- In vitro cell culture systems 1 – 2D systems and selected tests (genotoxicity and cytotoxicity, dose-response)
- Molecular biology principles 3 – stem cells and differentiation
- In vitro cell culture systems 2 – 3D organoid systems
- In vitro cell culture systems 3 – selected tests (e.g. FISH, smFISH)
- Cytotoxicity Test Final Exam

Prerequisites

Assessment Methods

- Intermediate Exam
- Written Protocol
- Written exam

Recommended Reading and Material	
Attendance	Attendance of at least 75% is mandatory, if more than 25% of the units are missed, the first exam entry will be lost.
Comments	

Robotics Engineering

Critical Thinking in Science

Degree programme	MRE
Semester	2
Course methods	SE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description

How can we compose a seamless narrative about a technical project that can be followed by all potential project partners and stakeholders, while doing justice to the project's complexity? We grasp the significance of a project when we understand why it is being done. Precise factual answers to the question "why" are the glue that holds a narrative together, connecting each part to the one that follows.We will explore each of the students' projects to identify and describe the real-life needs as well as the weaknesses in the technical state of the art or start state that the project addresses. We will practice the art of following every statement we make by addressing these questions: Why are you trying to solve these particular problems? Why are you using this strategy/technology/method? We can follow a complex technical process (even if we can't decipher the algorithms or code or the like) if we first see what the complete device or system is and does, before we are told how it was done.We will describe who the project benefits, the real-life as well as the technical reasons why it is being done, and what the project output is and does, before we explain how the end-user uses it, how it works, how it was done, and how well it works (the results/performance evaluation of the output). We will also consider potential project impacts in global technological, economic and environmental contexts, and use gender-neutral

	language.Each student will apply the critical methodologies practiced in the workshops to write the 2nd semester project abstract, and to craft, rehearse, receive and incorporate feedback on the project presentation.
Teaching methods	Seminar/Workshop/Writing and presentation assignments
Learning outcome	After passing this course successfully students are able to ... - Compose and effectively structure seamless narratives on complex technical projects and procedures by providing fact-based explanations of “why” for every statement made - Effectively and efficiently position a project as a response to a real-life problem or need - Demonstrate how a project addresses technical weaknesses in the state of the art and/or start state - Avoid mistaking the project output (what has been created and what it does) for the project results (how well it works, i.e. the performance evaluation of the project output) - Use the overview of the whole project output and what it does as the context for explaining how each part works and how it was done - Discuss choices of materials and methods in terms of their function (rather than as an inventory list) - Replace generalities with statistics and other facts, and use gender-neutral language - Compose and structure a master thesis and presentation in English
Course contents	- Workshopping the 2nd-semester project abstracts and presentations - Incorporating workshop feedback into the abstract and presentation composition process - Final version of abstract and presentation - Presentation practice and run-through
Prerequisites	Registered for MRE 2nd semester
Assessment Methods	- Assessment is based on the quality of the written and oral work and workshop participation. In a team project, any discernible differences in work quality and quantity will be reflected in individual grades.
Recommended Reading and Material	- Guidelines and instructions in course Moodle site
Attendance	75%
Comments	

Roboethics

Degree programme	MRE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Basics in ethics and societal impact of technology implementation
Teaching methods	Blended learning – short interactive theoretical inputs, deepening exercises in small groups, discussions, presentations
Learning outcome	After passing this course successfully students are able to ... - to link the acquired knowledge on ethical basics of technology development and application with the area of robotics
Course contents	- Basics, dimensions of responsibility etc, different ethical concepts, application of these notions within the context of sociotechnical systems
Prerequisites	none
Assessment Methods	- E-learning tasks. presentations, participation in discussions
Recommended Reading and Material	
Attendance	75%
Comments	

Probabilistic Robotics Lab

Degree programme	MRE
Semester	2
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course, students learn to model and apply modern methods for navigating mobile manipulators and service robots. Students will implement and subsequently analyze the filters and algorithms

	discussed in the course Probabilistic Robotics ILV in form of a semester project.
Teaching methods	Students will independently implement a predefined mobile robotics application within the Robot Operating System (ROS) framework in C/C++. Probabilistic filters (KF, EKF, particle filters) will be implemented, analyzed and discussed.
Learning outcome	After passing this course successfully students are able to ... - understand and analyze different methods for mobile robot navigation. - independently design and implement localization methods in C/C++
Course contents	- Probabilistic filters (KF, EKF, particle filters) - Localisation with maps - Feature extraction - ROS Framework (C/C++)
Prerequisites	Fundamentals algebra (matrix manipulation), fundamentals statistics (multivariate normal distributions and basic concepts, Bayes' theorem), robot kinematics, sensor technology (laser scanner, IMU and odometry, environment analysis), C/C++ under Linux
Assessment Methods	- 100% semester project
Recommended Reading and Material	- Thrun, S.; Burgard, W.; Fox, D.; Probabilistic Robotics; The MIT Press, 2005
Attendance	100%
Comments	

Probabilistic Robotics

Degree programme	MRE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	You will learn probabilistic robot localization approaches in this course. In the beginning of the lectures, you will learn to understand the fundamental problem of mobile robot localization and uncertainty in the context of motion and sensor noise. Based on these findings

	and fundamental concepts of statistics, we will derive the Bayes filter. This course discuss several implementations of the Bayes filter. You will learn to select appropriate models for a given problem. Based on the findings in this course, you will implement the algorithms in the laboratory part of this module.
Teaching methods	This course is based on knowledge from the first semester in the master's degree "program robotics engineering" as well as basic knowledge in robotics (e.g.: kinematics). You have to prepare yourself for this course. We assume, that you are able to derive kinematic models for mobile robots. Furthermore, we will not repeat fundamental concepts in linear algebra and statistics. Please recapitulate fundamental concepts before the first lecture. During the semester, you will have to prepare yourself (e.g.: missing knowledge in mathematical formulations) for each class. In the classes, we will discuss the methods and models in detail in order to obtain robust and reliable results.
Learning outcome	After passing this course successfully students are able to ... - formulate the localization problem in mobile robotics - reflect the approaches critically - select appropriate solutions for given localization problems
Course contents	- Fundamental robot localization - Localizing with maps - Modern robot localization
Prerequisites	- Algebra: Matrix manipulation- Statistics: basic concepts and multivariate Gaussian distributions- Bayes Rule: This is the fundamental approach for localization- Kinematics for robots: You must be able to get derive for different robots by yourself- Sensors: You must understand the output of different sensors, namely laser scanners, odometry and IMUs
Assessment Methods	- 100% written exam
Recommended Reading and Material	- Papers and textbooks are used in different chapters. The references are on the slides. - Thrun, S.; Burgard, W.; Fox, D.; Probabilistic Robotics; The MIT Press, 2005
Attendance	75% is mandatory
Comments	

Digital Leadership

Degree programme	MRE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

This course will provide an overview of the latest practical and theoretical leadership concepts. Students will gain practical insights into the challenges of leadership and transformation, for example, in international organizations, and they will also develop new perspectives on the contemporary world of work and the theme of leadership. One of the course's fundamental components will be a student created reflection on specific issues concerning leadership and their implementation.

Teaching methods

Learning outcome

After passing this course successfully students are able to ...
- identify and explain the tasks and instruments of leadership (for example, delegation, agreement on objectives) as well as to explain classical management models (for example, the leading continuum, the maturity model), to weigh the advantages and disadvantages of different leadership theories and concepts and to apply these to practical examples
- describe agile leadership (e.g. in expert organisations, transformation processes) and use it as an example of leadership
- explain the exact, academic, understanding of digital leadership (e.g. coaching culture) and apply this concept to specific cases
- apply the systemic loop (from the perspective of a leadership position) in a theoretical manner to interdisciplinary or intercultural teams
- understand the essential techniques of leadership in an intercultural context
- outline the most important trends in the labour market
- motivate employees and lead virtual teams in an increasingly digitalized world of work

Course contents

- Fundamentals of leadership, traditional traits, behavioural and situational theories of leadership
- Systems theory in social systems
- Leadership in a digital context

	- Modern leadership concepts (agile leadership, transformational leadership, servant leadership and other such theories) - Interdisciplinarity and interculturality - Trends in the economy: the labour market, globalisation, digital transformation and Industry 4.0 - The specifics of leading teams of experts
Prerequisites	none
Assessment Methods	- Participation in workshops, exercises, case studies, written exam
Recommended Reading and Material	- Berninger-Schäfer, E. (2019): Digital Leadership; Die Digitalisierung der Führung, managerSeminare Verlags GmbH - Franken, S. (2019): Verhaltensorientierte Führung; Handeln, Lernen und Ethik im Unternehmen, 4. Auflage, Gabler - Gasteiger, R., Kaschube, J., Rathjen, Ph. (2016): Interkulturelle Führung in Organisationen, Menschen in globalen Kontexten effektiv führen, essentials Springer Gabal - Greßer, K., Freisler, R. (2020): Ready for Transformation; Neue Arbeitswelt, digital und agil…, managerSeminare Verlags GmbH - Wunderer, R. (2011): Führung und Zusammenarbeit, Eine unternehmerische Führungslehre, 9. Auflage, Luchterhand - Lerch, Sebastian (2017): Interdisziplinäre Kompetenzen, UTB - Lüthi, E., Oberpriller, H., Loose, A., Orths, St. (2013): Teamentwicklung mit Diversity Management, Haupt - Wunderer, R. (2011): Führung und Zusammenarbeit, Eine unternehmerische Führungslehre, 9. Auflage, Luchterhand
Attendance	Attendance is compulsory
Comments	none

Innovation and Technology Management

Agile Software-Development & Lean UX

Degree programme	MTM
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	This course demonstrates to students the interplay between agile project management, user experience design, and its efficient and effective integration, known as "Lean UX." The acquired knowledge will be put into practice through several exercises and a concluding project.
Teaching methods	Self-study, lectures, discussions, group work, practical examples, online tutorials, project work
Learning outcome	Upon successful completion, students will be able to... Practically apply agile project management methods (including effort estimation, user stories, software requirements specification) Build and coordinate project teams in an agile environment Explain the essential characteristics of state-of-the-art user experience design and apply the most important methods in practice (including expert reviews, UI prototyping, discount usability evaluation) Plan and implement projects with a "Lean UX" perspective
Course contents	Agile Project Management (Scrum, Kanban, etc.) User Experience Software Development User Stories Effort Estimation in Software Projects Software Requirements Specification Relevant Standards Subject- and Expert-Based Methods Personas Prototyping Eye Tracking Usability Lab Minimum Viable Product Discount Usability UX Canvas
Prerequisites	Previous Knowledge Fundamentals of Computer science and the fundamentals of project management
Assessment Methods	Intrinsic performance (30%) + project work (70%)
Recommended Reading	Gothelf, Lean UX: Applying Lean Principles to Improve User

and Material	Experience, current edition Richter/Flücker, Usability and UX Compact: Products for People, current edition Roock/Wolf, Understanding and Successfully Implementing Scrum, current edition
Attendance	Attendance is generally mandatory
Comments	

Data Analytics

Degree programme	MTM
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description

Introduction to the methods, tools and procedure models of computer-assisted data analysis based on selected chapters. The course outlines the topic and conveys approaches for situational deepening of individual knowledge.

Teaching methods

Lectures on key topics (25%), self-study and discussion of topic-specific questions (50%), practical exercises with Python or Jupyter (25%), online tests to monitor learning progress.

Learning outcome

After passing this course successfully students are able to ...

- use Python, Jupyter, and scientific software libraries for data analysis
- manage, prepare and statistically analyse data and visualise it in a comprehensible way
- apply basic methods of data analysis to selected problems
- independently develop and apply advanced topics in data analysis

Course contents

- Introduction to Python, tools, software libraries and visualisation Process models, references and further information
- Regression

- Classification
- Clusters
- Decision Trees
- Time Series

Prerequisites	Programming skills and knowledge of linear algebra helpful
Assessment Methods	Participation and presentations (30%) Online-Tests (70%)
Recommended Reading and Material	• Data Science from Scratch, Second Edition, by Joel Grus (O'Reilly), 2019, ISBN 978-1-492-04113-9 • Code samples: https://github.com/joelgrus/data-science-from-scratch • The Complete Hands-On Machine Learning Crash Course, Marco Peixeiro, Towards Data Science (2019) • Storytelling with data, Cole Nussbaumer Knaflic (John Wiley & Sons), 2016, ISBN 978-1-19002260
Attendance	Attendance is mandatory
Comments	

Change Management

Degree programme	MTM
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Within the framework of this module, students will acquire knowledge and basic competencies in the field of organizational change management. Through sociological and psychological impulses, a thematic focus is placed on corporate purpose, sustainability, healthy work cultures and equity of opportunities. Experiential learning from a systemic, hypnosystemic and solution-focused view is key.
Teaching methods	Presentation, self-study, exercises, exchange of experiences, discussion, case studies
Learning outcome	After passing this course successfully students are able to ... - •distinguish types of change - •anticipate internal and external barriers to successful change

	- •identify success factors for change - •plan change management processes - •define the most important steps and measures for a concrete change - •understanding the reasons for resistance and using resistance as an opportunity for change - •understand the company in and its interactions with the society
Course contents	- •Types of change - •Phases of change - •Barriers to change - •Success factors for change - •Reasons why change efforts fail - •Change management - •Corporate Purpose - •SelbstwirkKRAFT®
Prerequisites	Basics of business studies
Assessment Methods	- •conceptualization (20%) - •peer-review (10%) - •group work (40%) - •individual reflection (20%) - •presentation (10%)
Recommended Reading and Material	
Attendance	The course will be held face to face in class. One session will take place in self-study mode. The final presentation will take place face to face. Attendance is compulsory as usual.
Comments	Further details will be provided in the Moodle Course.

Sports Technology

Digital Leadership and New World of Work

Degree programme	MST
Semester	4
Course methods	VO
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	In the course Digital Leadership and New World of Work, students gain practical insights into the leadership and transformation challenges e.g. in international organizations and develop a new view of the new world of work and the theme of leadership
Teaching methods	Contents are independently researched, presented and discussed. Lecturers and students systematically compare the results of their work with their practical experience. In this way, acquired knowledge is placed in relation to one's own work situation.
Learning outcome	After passing this course successfully students are able to ... - to outline the most important trends on the labour market and in HR management - to weigh the advantages and disadvantages of different leadership theories and concepts - to motivate employees and lead virtual teams in an increasingly digitalized world of work - to weigh the advantages and disadvantages of traditional and agile organizational structures (e. g. Holacracy etc.) - to design digital education measures for lifelong learning
Course contents	- Trends in the economy: globalization, digital transformation and Industry 4.0 etc. - Trends on the labour market: demographic change, diversity, changing values etc. - Trends in HR management (e. g. talent Management, digital HR, new organisations, age management, diversity management etc. - Traditional theories of property, behavior and situation of leadership - Modern leadership concepts (e. g. transformational leadership, agile leadership, servant leadership, etc.) - Leadership from a distance - Agile organizational models (e.g. Scrum, Holacracy etc.) - Competence requirements and transfer in the digitalised world of work
Prerequisites	no special prior knowledge required, practical work experience helpful
Assessment Methods	- Course immanent assessment method and written reflection (grade)
Recommended Reading and Material	- Franken, Swetlana (2016): Führen in der Arbeitswelt der Zukunft, SpringerGabler - Petry, Thorsten (2016): Digital Leadership. Erfolgreiches Führen in Zeiten der Digital Economy, Haufe Fachbuch

Attendance	Attendance is compulsory
Comments	

Start-up Management

Degree programme	MST
Semester	4
Course methods	VO
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	The course “Start-up Management” provides the essential methods and knowledge on how-) to develop a business idea and evaluate it using the Business Model Canvas, -) to evaluate a given business plan, -) to develop a business plan for a business idea, -) and to present a business model with a pitch deck.
Teaching methods	-) Theory lectures-) Video tutorials-) Material for self-study-) Teamwork-) Coaching sessions•Buzz groups•Feedback
Learning outcome	After passing this course successfully students are able to ... - -) develop an innovative business model, - -) evaluate it with a Business Model Canvas, and - -) present it with a pitch deck, - -) evaluate a given business plan - -) write a strategic business plan - -) get in contact with the startup scene
Course contents	- -) Why you need a business plan - -) How to write a business plan - -) Assumptions and estimates for a business plan - -) Where to find sample business plans and templates - -) Contents of a business plan - -) Evaluation of a given business plan - -) Business Model Canvas - -) Pitch deck - -) The Austrian start-up scene (incubators, business angels, investors, business plan competitions, etc.) - -) Team coachings
Prerequisites	Understanding the principles of business administration.

Assessment Methods	- The students will work in teams and will be graded as follows: - -) Description of the Austrian start-up scene: 10% - -) Pitch deck incl. detailed comments in the notes section of the pptx file: 90%
Recommended Reading and Material	- Kailer/Weiß, Gründungsmanagement kompakt, aktuelle Auflage - Genadinik, Alex, Business Plan Template And Example: How To Write A Business Plan: Business Planning Made Simple. Semantic Valley LLC. - Osterwalder, Alexander; Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley
Attendance	Attendance is generally recommended.
Comments	

Novel Data Analysis Approaches in Sports Technology

Degree programme	MST
Semester	2
Course methods	UE
Language	English
ECTS Credits	2.00
Incoming places	Limited

Monitoring and Feedback

Degree programme	MST
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In “Monitoring & Feedback”, students learn how to collect and visualize live performance data in (nearly) real time. Live-tracking athletes enables both rapid intervention in emergency situations and

	the accumulation of valuable data for later analysis. Since transmission speed is critical for evaluating and adapting athletic techniques while ensuring safety, the course emphasizes designing IoT platforms that transmit data over the Internet with minimal delay. Students gain practical skills in building systems that support both immediate live feedback and comprehensive post-event evaluation.
Teaching methods	- Theory lectures - Practical Exercises - Material for self-study - Teamwork - Continous Feedback
Learning outcome	After passing this course successfully students are able to ... - explain difference of working with batch data and live-data, - develope IoT Platform for live-monitoring and long-term batch analysis - identify applications and benefits of live-monitoring, - evaluate a long-term tracking data - visualize live and batch data
Course contents	- What is the internet? - Applying IoT concept for live-monitoring in athletics - MQTT - Live Data Analysis & Visualization - Using Live and Batch data for evaluation - Sending Live-Feedback based on Live-montored data
Prerequisites	ACSST (Pre-Semster Course), Python Programming Language
Assessment Methods	The students will be graded as follows: - Written Exam: 40% - Project: 60% consisting of Presentation with Demonstration (40%) & Paper (20%)
Recommended Reading and Material	- Scientific Visualization: Python + Matplotlib, Nicolas P. Rougier, Bordeaux, November 2021
Attendance	Lecture attendance is generally recommended but mandatory for written exam & presentation day.
Comments	

Monitoring and Feedback - Exercise

Degree programme	MST

Semester	2
Course methods	UE
Language	English
ECTS Credits	2.00
Incoming places	Limited

Instrumented Material Testing and Testing Systems

Degree programme	MST
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

FEM in Sports Technology

Degree programme	MST
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Instrumented Material Testing - Exercise

Degree programme	MST
Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

FEM in Sports Technology - Exercise

Degree programme	MST

Semester	2
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Design

Degree programme	MST
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Material for Sports Equipment

Degree programme	MST
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Mobile data capturing

Degree programme	MST
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	In this course, the students have the opportunity to apply and deepen the contents of the previous LV "Applied Measurement Technology in

	Sports Technology". By working out a measuring chain with different components from different manufacturers, many tasks can be independently worked on in the future.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to discuss the advantages and disadvantages of different platforms (e.g. microcontroller (Arduino), single board computer (Raspberry Pi), measurement applications (LabVIEW)) with regard to their possible use for mobile data acquisition in the field of sports technology. - use a mobile data acquisition platform suitable for a measurement task in the field of sports technology. - record data from multiple sensors during field measurements.
Course contents	- Presentation of various current platforms, such as Arduino, Raspberry Pi and LabVIEW, which are suitable for mobile data acquisition in the field of Sports Technology - Discussion of the requirements for a platform for mobile data acquisition in the area of Sports Technology. - Exercises for creating the individual components of a measurement chain. - Based on the contents of the LV Angewandte Messtechnik in Sports Technology (1st semester), the measurement chain will be extended by a suitable platform for mobile data acquisition and measurements will be performed on sports equipment and/or participant.
Prerequisites	Content of the course "Angewandte Messtechnik in Sports Technology"Content of the course "Angewandte Informatik in Sports Technology"
Assessment Methods	- Course immanent - Final exam
Recommended Reading and Material	- Current scripts and manuals for the platforms used
Attendance	Attendance is mandatory.
Comments	

Sports Practice Measurement Week - Summer

Degree programme	MST
Semester	2

Course methods	PRJ
Language	English
ECTS Credits	3.00
Incoming places	Limited

Sports Technology Project 2

Degree programme	MST
Semester	2
Course methods	PRJ
Language	English
ECTS Credits	2.00
Incoming places	Limited

IT-Security

Scientific Writing

Degree programme	MCS
Semester	4
Course methods	SE
Language	English
ECTS Credits	1.50
Incoming places	Limited

Course description	This course focuses on scientific writing with an emphasis on writing effective grant proposals. Students will learn to approach scientific writing as both a product and a process. The course includes practical activities that guide participants through collaborative idea generation, proposal drafting, and presenting a final proposal in a collaborative setting. The course is not designed to help students prepare for their master thesis but helps them to better understand the principles of designing future research, thinking critically about interdisciplinary opportunities, and addressing complex research challenges (which may prove useful in the master exam).
Teaching methods	Lectures: Introductions to key concepts, including the structure and purpose of scientific grant proposals.Collaborative Writing Labs:

	Group activities to draft and refine different sections of a proposal.Peer Review: Collaborative review to improve drafts and develop team writing skills.Proposal Presentation: Preparation for presenting and defending proposals in front of peers.
Learning outcome	After passing this course successfully students are able to ... - Understand the purpose and function of scientific writing in securing research funding. - Recognize the steps involved in the writing process and apply them to their own work. - Draft a clear and well-structured grant proposal. - Co-author texts in groups to develop and refine ideas.
Course contents	- Writing interdisciplinary science. - Understanding the rhetorical principles of grant writing. - Framing research questions for different audiences. - Identifying unanswered questions in research. - Analyzing calls for proposals and funding opportunities. - Structuring and drafting a scientific grant application. - Writing labs focused on idea generation, proposal refinement, and co-authorship. - Preparing and delivering a proposal presentation.
Prerequisites	
Assessment Methods	- In-Class Activities (60%): Participation in group writing sessions (In-Class) - Proposal Presentation and Defense (40%): Groups will present their proposals and respond to feedback and questions. (In-Class)
Recommended Reading and Material	
Attendance	Compulsory
Comments	Students are expected to be fully cognitively present in their writing. This course emphasizes the development of independent critical thinking and decision-making skills. While digital tools may assist in the writing process, students must avoid over-reliance on them. The goal is to engage deeply with the content, ensuring that all ideas, analyses, and arguments originate from their own understanding. Offloading cognitive effort to tools like AI or automated writing systems is discouraged, as it detracts from the learning objectives of the course.

Industrial Engineering & Business

Int. Marketing and Product Management

Degree programme	MIB
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description

Internationalization, globalization and culturalization are currently known as key success factors of market and brand leadership. According to the current meaning students shall gain an overview of decision fields and peculiarities of international marketing in theory comparison and in the dispute with practice-oriented decision-making situations based on case studies. In particular, students should learn to understand the strategic challenges of market-oriented internationalization strategies and shall name the resulting consequences and requirements on the analysis, Market Selection- and positioning decision and apply. Using practical examples, the students will be sensitized between mainstream marketing and International Marketing with respect to the differences in the marketing mix and should – from the perspective of an acting marketing head - acquire knowledge to build, implement and guide a comprehensive internationalization process from the perspective of marketing communication.

Teaching methods

Learning outcome

After passing this course successfully students are able to ...

- explain the main spheres of activity of nternationalization by Kotler and implement their consequence on the basis of practical cases decisions (Case Studies).
- apply cultural influences on the models of Hofstede, Hall and Thomas as an evaluation basis for environmental analysis and market selection to analyze their influence on the assessment of market attractiveness and to develop appropriate market selection programs.
- assess different brands from the FMCG, IGM and DLM regarding their internationalization and positioning strategies and identify the differences in the respective marketing mix.
- implement the essential decisions of internationalization based on a

	Case Study in objective, market selection and program design (marketing mix development) and to justify their choices from the perspective of marketing managers. - identify the essential model and approach differences in the product, price, distribution and communication policy between mainstream marketing and international marketing, to interpret their impact on the company's success and its market position and to develop plans for an independent marketing mix based on given project tasks in the context of an internationalization strategy at the level of the market leaders.
Course contents	- Introduction to the global product and brand management - Global product strategies and their origins - Management of global brands during the product life cycle - Standardization versus adaption - Analysis of various branding strategies based on familiar examples
Prerequisites	- Basic Knowledge of Mainstream Marketing and Business Administration- English speaking and writing | Level C1
Assessment Methods	- written exam (75%) - exams via Moodle (each 5%, total 25%)
Recommended Reading and Material	- Hollensen (2012): Essentials of Global Marketing, Pearson - Müller/Gelbrich (2004): Interkulturelles Marketing, Vahlens - Usunier/Lee (2012): Marketing Across cultures, Pearson
Attendance	Attendance is compulsory
Comments	

Data Science

Multivariate Statistics

Degree programme	MDS
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	This course covers advanced topics for the exploratory and inferential analysis of multivariate data. Applications are based on R.

Teaching methods	Blended learning.
Learning outcome	After passing this course successfully students are able to ... - preprocess and visualize multivariate data - apply methods to reduce dimensionality (Principal Components Analysis, Multidimensional Scaling) - apply selected time series analysis methods - fit generalized linear models (logistic regression, regression models for count data), do diagnostics and apply them for prediction. - carry out an hierarchical cluster analysis and assess the quality of the solution
Course contents	- Distances, Covariances and Correlation - Visualization Methods for multivariate data (Trellis, parallel coordiantes, faces ...) - Principal Component Analysis - Multidemensional Scaling - Long-term forecasts (using regression), ARIMA models - Logistic Regression, Poisson Regression, Negative Binomial Regression - Hierarchical Cluster Analysis
Prerequisites	Probability Calculus; Applied Statistics, Statistical Computing
Assessment Methods	- Continuous assessment examinations - Project report
Recommended Reading and Material	- Everitt, Hothorn, 2011: An introduction to multivariate data analysis with R. Springer. - Faraway, 2014: Linear Models with R (Second Edition). CRC Press. - Faraway, 2016: Extending The Linear Model with R (Second Edition). CRC Press. - Hyndman, R.J., & Athanasopoulos, G. (2018) Forecasting: principles and practice, 2nd edition, OTexts: Melbourne, Australia. OTexts.com/fpp2.
Attendance	Mandatory attendance
Comments	

Smart City (Specialisation)

Degree programme	MDS
Semester	2
Course methods	ILV

Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	IoT and intelligent technologies in smart cities are current and leading-edge topics which will experience further growth and innovations in the fields of energy, ICT and mobility in upcoming years.
Teaching methods	Problem based learning
Learning outcome	After passing this course successfully students are able to ... - explain topics and fields of action, as well as challenges, e.g. in the areas of energy and mobility of a smart city. - define and implement use cases related to Edge, Cloud & Fog computing. - process Open Data datasets and implement use cases (e.g., analyze, combine, and visualize). - retrieve data via different transmission technologies (LoRa, Nb-IoT, Bluetooh, WiFi, 4G/5G) and from selected interfaces.
Course contents	- Smart City fields of action, challenges, typical problems and use cases - Reading and processing sensor data - Use of different transmission technologies - Processing and analysis of the data using Node-RED, InfluxDB & Grafana - Analysis and combination of Open Data datasets
Prerequisites	Courses:-) Basic Algorithms & Data Structures-) Data Science Infrastructure-) Scripting
Assessment Methods	- 25% exercises - 50% Project execution - 25% Workshop conduction to the project
Recommended Reading and Material	
Attendance	generally mandatorymax. 20% absences (tolerance limit)missed contents and assignments have to be compensated in self-study (independently).
Comments	

Natural Language Processing (Specialisation)

Degree programme	MDS
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The course covers Natural Language Processing AI technologies. Methods for processing speech data are examined. Standard algorithms as well as the latest models from research are used. In addition, exploratory data analysis and various possibilities for text processing are covered.
Teaching methods	Lecture with many examples and exercises
Learning outcome	After passing this course successfully students are able to ... - •provide an overview of relevant methods of speech processing (NLP), speech recognition and speech synthesis and implement a real application scenario - •develop an NLP module using selected standard libraries in Python and survey the quality of the solution
Course contents	- •Basics of Natural Language Processing and Python libraries for text analysis - •Preprocessing of language data, feature engineering (word embeddings) and models for application to NLP tasks (e.g. classification and information extraction) - •From standard models to deep learning and transformers
Prerequisites	Proficiency in Python Basics of Machine Learning
Assessment Methods	- •Course-immanent assessments - •Exam
Recommended Reading and Material	- •Vajjala, S. et al. (2020). Practical Natural Language Processing.
Attendance	
Comments	

Machine Learning

Degree programme	MDS
Semester	2

Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This module provides an introduction to machine learning.
Teaching methods	Presentations, Exercises, Discussion
Learning outcome	After passing this course successfully students are able to ... - select an appropriate Machine Lerning method for a given task - explain the most common Machine Learning methods - apply the methods using software, and to interpret the results - evaluate the performance of methods and to compare them.
Course contents	- Fundamentals of Statistical Learning - Supervised Learning (Classification, Regression): k-Nearest Neighbour, Naive Bayes, Trees, Random Forests, Neural Networks, Support Vector Machines, Ensemble Methods (Bagging, Boosting) - Unsupervised Learning (Clustering): k-Means, DBSCAN - Performance Evaluation and Benchmarking of ML Algorithms (Confusion Matrix, Accuracy, Recall/Precision; ROC Curve, Lift Chart) - Experimental Design of Benchmarking Experiments
Prerequisites	Applied Mathematics, Statistics
Assessment Methods	- Exercises - Exam
Recommended Reading and Material	- James/Witten/Hastie/Tibshirani, 2017. An Introduction to Statistical Learning. Springer.
Attendance	Mandatory
Comments	

Tissue Engineering and Regenerative Medicine

Bioreactors and Biophysical Pathways

Degree programme	MTE
Semester	2
Course methods	ILV
Language	English

ECTS Credits	2.00
Incoming places	Limited
Course description	The students obtain knowledge about bioreactors in tissue engineering and biophysical therapies in the field of regenerative medicine applications. Furthermore basic concepts regarding design and triggered cellular and tissue effects will be discussed.
Teaching methods	VO - Basics and TheorySE - Discussion of Examples and Modells for BioreactorsSE - Discussion of Design Concepts and Outcomes
Learning outcome	After passing this course successfully students are able to ... - define the term „Bioreactorsystems in Tissue Engineering" and differentiate them from bioreactors in biotechnology - define the common bioreactor types and explain their working principle. - explain the main idea of the "in vivo bioreactor" concept with examples from the course. - define the two main rationales to use bioreactors in tissue engineering. - evaluate advantages and disadvantages of different bioreactor systems in regard to their application for a specific tissue type. - develop a basic bioreactor system for a certain organ/tissue and simulate elementary processes inside the bioreactor. - explain common types of sensors for bioreactor systems and apply these sensors on a specific bioreactor application. - to give an overview of biophysical therapies - to describe working principles of biophysical therapies - to explain the choice of laser- as well as light therapies for trauma-related diseases
Course contents	- Mechanics of Bioreactors - Electronical Control Design of Bioreactors - Connecting Points to Bioreactors used in Biotechnology - Feedback Control Basics - Literature Discussion of Common Bioreactor Types (including critical discussion) - Discussion of Commerically Available Biorecator Systems - Interdisciplinary Approach on the Design of Bioreactors for Tissue Engineering - Key Parameters involved in Bioreactor Design - Scaffolds and Constructs for Bioreactor Systems (including adapted Fabrication Techniques)

	- Control and Feedback Control in Mechatronics for Mechanical Stimulation - Basics of Mechanotransduction - Signalling Pathways - Biosensors and Actors for Bioreactors - "Functional Tissue Engineering” - "in-vivo” Bioreactors - idea and current approaches - "Lessons learned from research projects of the FHTW"
Prerequisites	Cell Biology; Basic knowledge on Mechanics, Electronics, Biomaterials and Cell Cuture
Assessment Methods	- Course immanent assessment method and end 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 - C. Kasper, M. Van Griensven, R. Pörtner (2008): Bioreactor Systems for Tissue Engineering, Springer - Relevant publications will be provided via moodle course
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	

Biotechnology & Extracellular Vesicles

Degree programme	MTE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Biotechnology underpins a vast array of applications, ranging from biopharmaceuticals and industrial enzymes to research tools and agricultural innovations, and is a cornerstone in the development of therapeutics such as monoclonal antibodies, vaccines, and other biomolecules. The design and optimization of recombinant protein production are dicussed in this lecture series, and basics and theory

	of biotechnology are presented within interactive lectures, including practical examples for its application.Extracellular Vesicles gained extreme scientific attraction in the last years. They are thought to be relevant for inter-cellular communication, thus being a reasonable way of improving targeted therapies, but also as biomarkers for pathologies. In the course of this lecture series, the biology of EVs, purification and characterization, and possible therapeutical applications of EVs will be discussed.
Teaching methods	frontal lecture, Case studies are discussed in seminars.
Learning outcome	After passing this course successfully students are able to ... - design bioprocesses for the production of recombinant proteins from gene to purified product applying microbial and/or mammalian systems - choose the appropriate expression systems and plasmids for recombinant production - define strategies for product development and expression systems - characterize a concept and principle of bioprocess design (up- and downstream processing) - design and characterize various bioreactor types - apply high-level data exploration and interpretation - combine of gained knowledge with scientific state of the art - characterize, interpret, and apply function and interactivity of complex systems - understand the biology of EV-genesis, and purification and characterization techniques of EVs - explain possible therapeutical applications of EVs
Course contents	- Recombinant protein production: (1) Basics and expression strategies - Expression hosts: (1) overview: Pro- and eukaryotic expression systems - Upstream Processing (USP): (1) Mass balance and kinetics, (2) Process modes (batch, fed-batch, continuous), (3) Bioreactor types and bioreactor design (mass transfer), (4) Process monitoring and control - Downstream Processing (DSP): (1) DSP design, (2) DSP Unit operations: A) Cell separation (centrifugation, filtration) and cell disintigration, B) Protein Purification (Chromatography) - Continuous manufacturing: (1) USP, DSP and analytics - Multivariate data analysis: (1) Design of Experiments (DoE) - Biology of EVs - Therapeutical applications of EVs

	- Characterization techniques of EVs
Prerequisites	Molecular and Cellular Biology in Regenerative Medicine, Proteinchemistry
Assessment Methods	- final exam
Recommended Reading and Material	- Bioprocess Engineering Principles, Pauline M Doran, 2nd edition ISBN 978-0-12-220851-5 - Bioprozesstechnik, Horst Chmiel, ISBN 978-3-8274-2476-1 - Taschenatlas der Biotechnologie und Gentechnik, Rolf D. Schmid ISBN 978-3-527-33514-5
Attendance	Attendance is mandatory in this course, only 25% of absence is tolerated. In case you miss more than 25% you lose the first try in the exam.
Comments	

Gene Regulation and Signal Transduction

Degree programme	MTE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course Gene Regulation and Signal Transduction (GRST) covers central aspects of signal transduction in the context of tissue engineering and regenerative medicine. The lectures present basics and applied examples from various signaling pathways (RAF-MEK-ERK, mTOR/AKT, PI3K, Wnt/beta-catenin, BMPs, Smads), DNA Damage und apoptotic signaling cascades, and other aspects of cellular signaling relevant in tissue engineering applications. The role of epigenetics, mechanotransduction, and the nuclear architecture will be discussed in context of regenerative processes.
Teaching methods	frontal lectures
Learning outcome	After passing this course successfully students are able to ... - describe components and regulation of important signaling pathways (e.g. Raf-MEK-ERK, PI3K-AKT-mTOR; BMPs, Smads) and mechanisms of mechanotransduction

	- explain epigenetic mechanisms in regenerative processes - explain DNA damage signaling pathways and regulation of apoptosis in TE applications - interpret the results of typical experiments in the field of signal transduction (Western blots, IPs...) - explain the importance of signal transduction in tissue engineering
Course contents	- signaling pathways (RAF-MEK-ERK, mTOR/AKT, Wnt/beta-catenin) - apoptosis - DNA damage signaling - machanotransduction - aspects of cellular signaling in Tissue Engineering
Prerequisites	Molecular and Cellular Biology in Regenerative Medicine (MBRM)
Assessment Methods	- written final exam
Recommended Reading and Material	- current scientific literature suggested by lecturers
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	

AI Engineering

Development Project

Degree programme	MAI
Semester	2
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	An AI project is implemented, usually with domain-specific tasks. The projects are linked to the topics of the R&D areas at the University of Applied Sciences Technikum Wien. e.g. Healthcare, Smart Mobility, Smart Cities, Service Robotics, Security or Game Engineering. The game specialization develops a computer game as a group work

	while the AI specialization carries out several prediction challenges.
Teaching methods	independent working with supervision
Learning outcome	After passing this course successfully students are able to ... - define and plan the project - prepare and present a project pitch
Course contents	- project management - presentation techniques - documentation of projects
Prerequisites	experience from projects of the bachelor degree
Assessment Methods	- assessment during lectures (Game) and Prediction Challenge (AI)
Recommended Reading and Material	
Attendance	
Comments	

Scientific Papers in AI

Degree programme	MAI
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This course prepares the students for writing their AI master thesis and the AI master paper. After a short repetition of the scientific work principles, a large part of the course focuses on journal clubs about AI papers. The latest publications as well as classic important AI papers are read and presented by the students. This is followed by a critical discussion and group evaluation.
Teaching methods	combination of lectures and own presentations
Learning outcome	After passing this course successfully students are able to ... - identify different types of scientific work - use different types of English literature - reason about subject-relevant research question based on the state-of-the-art collected from scientific points of view and to

	formulate it in a comprehensible manner, and to define verifiable criteria for achieving goals - independently plan the phases of a scientific development or investigation using conventional methods, carry them out in a targeted manner, document them in a comprehensible manner, and thereby systematically ensure the traceability, reliability, plausibility and transferability of the findings to comparable problem situations or contexts - to select and apply suitable methods for the respective question, and accordingly to write the structure of a master's thesis, a proposal and then the master's thesis - present own scientific work as well as scientific work of other people
Course contents	- scientific working, writing and methods - finding relevant AI publications - understanding and presenting AI publications
Prerequisites	successfully completed bachelor thesis
Assessment Methods	- contributions during lectures and own presentations
Recommended Reading and Material	- Kornmeier, (2016). Wissenschaftlich schreiben leicht gemacht: Für Bachelor, Master und Dissertation, utb.
Attendance	
Comments	

Quantum Engineering

Quantum Communication Laboratory

Degree programme	MQE
Semester	2
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this lab course students implement quantum key distribution protocols both in free space and in fiber, thus supporting an experience-orientated approach to quantum key distribution.

Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - implement the BB84-protocol in free space - implement the BB84-protocol in fiber - exchange keys using the BB84-protocol - detect eavesdropping in the BB84-protocol - implement the E91-protocol in free space - implement the E91-protocol in fiber - exchange keys using the E91-protocol - evaluate laser safety measures - couple a laser into a fiber - extract a sifted key from a raw key - calculate the QBER - use a quantum random number
Course contents	- Implementation of QKD protocols in free space transmission - Implementation of QKD protocols in fiber transmission - Quantum Key Generation
Prerequisites	Laser Safety (QUINFL)Realization and manipulation of photonic qubits (QUINFL)Prepare and measure protocols for QKD (part of QUCOM1)Entanglement based protocols for QKD (part of QUCOM1)
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Technical manuals, scripts
Attendance	
Comments	

Technology Trends in Quantum Engineering

Degree programme	MQE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Analysis of scientific publications and important publications in the field of quantum technologies. A selection of current issues of

	quantum engineering is worked on in small groups with experts, using problem-based learning methodology
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to analyze and discuss current problems of quantum technologies 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 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	- technology trends in quantum engineering - analysis of scientific publications in the subject area
Prerequisites	Knowledge on quantum information, quantum computing, enabling technologies, physics, electronics
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Material for reading and discussions will be provided throughout the course
Attendance	
Comments	

Data Modeling Lab

Degree programme	MQE
Semester	2
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course students apply numerical methods for analyzing and processing experimental data.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - read and interpret experimental data - extract model parameters from experimental data by curve fitting - depict experimental data graphically - analyze experimental data - create images from raw data fit for publication or presentation to an expert audience - present experimental data
Course contents	- Introduction to data processing in python - Curve fitting methods - Presentation experimental data
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Advanced Optics

Degree programme	MQE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00

Incoming places	Limited
Course description	The course introduces some concepts of quantum optics. The concept of temporally low and high coherent light sources is introduced. The application of the concept of temporal coherence is demonstrated using the example of different types of interferometers. After introducing the theory of complex-valued dispersive refractive index functions, their technical manipulation is applied using the example of a series of electro-optical modulators. The basics of light sources, interferometers and electro-optical modulators learned are applied to examples from research and medical technology.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - to explain the setups for deriving spatial and temporal coherence and to derive the characteristic quantities, especially the coherence length - explain the connection between coherence and interference properties - name different light sources of low and high coherence - to assign the characteristic properties of different light sources to low and high coherence and to derive areas of application for the different sources - to record various interferometer setups (Michelson, Mach-Zehnder (macro[reflection & transmission] & micro), Hong Ou Mandel (reflection & transmission), Fabry–Pérot) and explain how they work. - to calculate the mathematical relationship between resonance frequencies and dispersion of the complex refractive index - name different electro-optical modulators and explain their basic functionality - list applications of interferometers and electro-optical modulators
Course contents	- Coherence theory (spatial and temporal coherence, definition setups, following interference properties) - Light sources (low temporal coherent: LED and superluminescent light sources, high temporal coherent: lasers of various setups + functional principles of lasers) - Interferometry (introduction of different interferometers: Michelson, Mach-Zehnder (macro[reflection & transmission] & micro), Hong Ou Mandel (reflection & transmission), Fabry–Pérot) - Theory of complex refractive indices including dispersion - Electro-optical modulators (optical Kerr, Pockels, scattering

	[Brillouin & Raman], Franz-Keldysh) and application of the modulators especially in micro- and nanostructured integrated setups) - Applications of various interferometers and electro-optical modulators
Prerequisites	-Mathematical calculations with complex quantities (amplitudes, phases) (MAQE)-Wave optics at bachelor level (HOPH)-Knowledge of physics (optics, electronics, quantum theory) at bachelor's level (HOPH)-Engineering knowledge (optical devices, electronics, information theory) at bachelor's level (HOEL,QECE,QEP)
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Boyd. Nonlinear Optics. Elsevier Inc. 2020. - Moloney & Newell. Nonlinear Optics. CRC Press, Taylor & Francis Group. 2018. - Feynman, Leighton & Sands. Lectures on Physics. part 1. Pearson/Addison-Wesley. 2011/2013. - Scripts
Attendance	
Comments	

Quantum Programming Languages

Degree programme	MQE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course provides an overview on state-of-the-at programming languages and frameworks for quantum computing.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - discuss the specificities of different quantum programming languages/frameworks - use existing software for specific applications such as quantum error correction and noise simulations

	- describe and compare advantages and use cases for different quantum programming frameworks - implement simple quantum algorithms on different quantum computing platforms - choose a programming language suited to solve a given problem
Course contents	- Quantum computing frameworks and languages, e.g. qiskit, Cirq, Q#, t|ket, Ocean, quTip - Existing software and packages for specific applications - Creating your own toolkit - Interfaces to control software of quantum hardware
Prerequisites	Quantum Computing I (QUCP1), Python (HOCS), Enabling technologies I (QET1)
Assessment Methods	
Recommended Reading and Material	- Documentation, Skriptum
Attendance	
Comments	

Foundations of Quantum Information

Degree programme	MQE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description	This course delves into the wide field of interpretations surrounding quantum mechanics, providing students with a deep understanding of the philosophical and conceptual foundations of the quantum world. From the measurement problem to entanglement and hidden variables, participants will engage in thought-provoking discussions on the diverse perspectives that shape our comprehension of quantum phenomena. By the end of the course, students will be equipped with the knowledge to critically evaluate and contribute to the ongoing dialogue surrounding the interpretations of quantum mechanics.

Teaching methods

Learning outcome

After passing this course successfully students are able to ...

- Critically evaluate and articulate the historical and philosophical foundations of quantum mechanics, including key debates and interpretational challenges.
- Analyze the implications of foundational principles on the conceptual framework of quantum mechanics.
- Investigate the measurement problem in quantum mechanics, understanding the intricacies surrounding the role of measurement, observer effects, and the collapse of the wave function.
- discuss the phenomenon of quantum entanglement and its consequences for nonlocal correlations.
- Analyze the challenges posed by nonlocality and investigate its impact on our understanding of the locality principle in classical physics.
- Discuss the debate between realism and the role of hidden variables in the EPR paradox.
- Analyze the development and significance of Bell inequalities in testing the predictions of quantum mechanics.
- Investigate the violation of Bell inequalities as evidence for non-local correlations and the departure from classical physics.
- Engage in the debate between quantum realism and instrumentalism, assessing the ontological commitments and epistemic implications of each perspective.
- Evaluate how different interpretational stances influence one's understanding of the nature of physical reality in quantum mechanics.
- Explore contemporary developments and emerging perspectives in the field of quantum mechanics, with a focus on interpretational challenges.
- Discuss open questions, unresolved issues, and potential future directions for research in the context of quantum mechanics interpretations.

Course contents

- Philosophical Foundations of Quantum Mechanics
- Observer Effects and Measurement Problem
- Entanglement and Non-locality
- Quantum Realism vs. Instrumentalism
- Hidden Variables and Bohmian Mechanics
- Probabilities in Quantum Information

Prerequisites

Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Jammer M. (1974) The Philosophy of Quantum Mechanics: The Interpretations of Quantum Mechanics in Historical Perspective, Wiley - Freire O. (2022) The Oxford Handbook of the History of Quantum Interpretations
Attendance	
Comments	

Quantum Communication I

Degree programme	MQE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This course introduces the principles of cryptography and quantum key distribution (prepare-and-measure protocols, entanglement-based QKD protocols).
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... - describe the principles of cryptography - define symmetric encryption and give examples for symmetric encryption algorithms - define asymmetric encryption and give examples for asymmetric encryption algorithms - program an algorithm for RSA encryption - program an algorithm for AES encryption - give an overview over the OSI modell - describe the authentification problem in quantum key distribution (QKD) - discuss the consequences of the no-cloning theorem in QKD - discuss degrees of freedom in which information can be encoded in QKD - describe prepare-and-measure protocols for QKD - discuss the safety of prepare-and-measure protocols for QKD

	- describe entanglement based protocols for QKD - discuss the safety of entanglement based protocols for QKD - describe the effect of eavesdropping in both prepare-and-measure protocols and entanglement based protocols - describe the effect of noise in both prepare-and-measure protocols and entanglement based protocols - explain how a sifted key is generated from a raw key - calculate the Quantum Bit Error Rate (QBER) - describe use cases for QKD
Course contents	- Principles of classical symmetric and asymmetric cryptography - Foundations of quantum key distribution - Prepare-and-measure protocols for QKD - Entanglement based protocols for QKD - Quantum key generation from raw quantum keys
Prerequisites	Fundamental principles of quantum information (QUINF)Principles of network technology (HOCS)
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Paar & Pelzl: Understanding Cryptography - BSI Technical Guideline BSI TR-02102-1 Cryptographic Mechanisms - Wolf: Quantum Key Distribution. An Introduction with exercises - Gisin, Ribordy, Tittel & Zbinden: Quantum cryptography
Attendance	
Comments	

Quantum Engineering Project

Degree programme	MQE
Semester	2
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course provides a hands-on approach to guide small groups or individual students through a well-defined project. Possible topics cover all aspects of quantum engineering, including the design and stabilization of optical systems, device characterization or software

projects. This course furthermore provides a scenario to practice team leadership.

Teaching methods

Learning outcome

After passing this course successfully students are able to ...
- independently perform basic steps in designing and setting up optical or electronic systems or designing and testing software
- explain the theoretical background, mechanisms, advantages and disadvantages and application scenarios of these system
- identify relevant literature, write a scientific introduction and develop and implement a working plan on a given topic
- comprehensibly analyze, critically evaluate and interpret their performance with the help of scientific-systematic methods, to summarize them in a written report according to the standard of scientific working and to present their results to supervisors, lecturers and fellow students
- record experimental data in a laboratory book in a comprehensible manner
- approach and solve scientific problems within a team
- 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 and reference these in their own work
- plan the phases of an engineering task and document it comprehensibly
- relate research results to industry, society, the economy or the environment
- diagnose dynamics in project teams and to develop and argue case-related concrete opportunities for activities (for example delegation of responsibilty, critical discussion)

Course contents

- Scientific literature research and writing of a scientific introduction
- Design and setup of optical and electronical systems
- Construction of optical systems
- Feedback and optimization
- Analysis and interpretation of data from experiments or simulations
- Writing a scientific report
- Leadership functions and tasks, Leadership tools in project teams, Leading without formal power and competence,
- Conflicts and difficult situations in leading project teams
- Presentation of the obtained data in front of an auditorium (consisting of the other teams and supervising lecturers)

Prerequisites	Basic knowledge about electronics and optical systems and corresponding lab experience (HOPH, HOEL)Electronic control engineering (QECE,QECE lab)Programming in python (HOCS)Digital Leadership
Assessment Methods	- Submission of a project report, including introduction, description of the project tasks, results, scientific references - Presentation of the project in front of an audience (other students and lectureres)
Recommended Reading and Material	- State-of-the-art scientific literature (publications) - Technical manuals, scripts - Haeske, U. (2008): Teamentwicklung, Berlin: Cornelsen Verlag, [bilingual book: in English and German]
Attendance	
Comments	

Enabling Technologies II

Degree programme	MQE
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Mechanical Engineering

Computational Fluid Dynamics

Degree programme	MMB
Semester	2
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description	Introduction to Computational Fluid Dynamics (CFD) - theory and application of numerical flow calculation programs.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Sustainable Mobility and Transport

Degree programme	MMB
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	The course deals with topics related to the sustainability of mobility and implementation options for ecological transport, such as the minimization of fuel consumption or the use of alternative drive concepts (hydrogen, fuel cells, e-mobility)
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Circular Economy

Degree programme	MMB
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course provides insights into the consideration and implementation of sustainability in the course of product development in mechanical engineering (resource planning, waste production, emissions, recycling, etc.).
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Case Study

Degree programme	MMB
Semester	2
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The course case study is a kind of practical guide for the

	implementation of projects in the field of machine learning and artificial intelligence. Using a data set from the field of predictive maintenance, a machine learning case study is performed: from structuring the project to rolling out and embedding the model in operational decision making. We learn about common concepts for conducting machine learning case studies, such as CRISP-DM, EDA (Exploratory Data Analysis), Feature Engineering, Cross-Validation and Explainable AI. These concepts can be explored on a data set in greater depth during the project week.
Teaching methods	Lecture with interactive elements and project work
Learning outcome	After passing this course successfully students are able to ... - supervise the practical implementation of a machine learning project as a domain expert/project manager - organize a machine learning project team, i.e. apply project management techniques and tools - understand the practical aspects of creating machine learning models - understand as a domain expert/project manager how to successfully implement projects, i.e. integrate them into operational decision-making processes - develop a machine learning model with a simple data set
Course contents	- 1.1 Definition of the project objective: Implementation of a case study from predictive maintenance - 1.2 Organization and structuring of a machine learning use case - 2. Data preparation and data understanding - 3.1 Developing a machine learning model: from feature selection to testing the model - 3.2 Validation of the model and communication of the model results - 4. Integration of the model into operational decisions and maintenance
Prerequisites	MMB-2-VZ - Machine Learning Basics
Assessment Methods	- project presentation
Recommended Reading and Material	- Géron, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems. O'Reilly Media. (n.d.). - Müller, A. C., & Guido, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists. O'Reilly Media. (n.d.).
Attendance	
Comments	

Machine Learning Basics

Degree programme	MMB
Semester	2
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description

The course gives a practical insight into the basics of machine learning. We are at the beginning of an era where artificial intelligence will influence, if not take over, operational decisions in industrial applications. It is therefore important to develop assessment skills for machine learning applications. The goal is therefore not to rigorously learn the mathematical and programming skills to build machine learning models. Rather, future project managers and domain experts should be able to understand basic principles in order to decide how machine learning models can help improve processes and products. Particular attention is paid to the latest developments in the field of generative AI.

Teaching methods

Lecture with interactive elements (online resources and opportunity for self-study)

Learning outcome

After passing this course successfully students are able to ...
- Understand basic concepts and principles of machine learning
- Understand application scenarios and assess potential use cases (evaluation competence)
- Outline a machine learning project process
- Apply the basics of supervised and unsupervised learning to own project ideas
- Assess the quality of machine learning results

Course contents

- 1.1 Fundamentals: Use Cases, central definition of Machine Learning, distinction from classical programs, differentiation from other areas of artificial intelligence
- 1.2 A new era of artificial intelligence with the emergence of Large Language Models?
- 1.3 How are ML applications already being used in companies, and what potential does ML have in the future?
- 2.1 Understanding key concepts: Supervised Learning vs.

	Unsupervised Learning vs. Reinforcement Learning. - 2.2 The most crucial ingredient for Machine Learning models: Data - 2.3 Roles in a Machine Learning project and project phases - 3. Getting to know an End-to-End Machine Learning project - 4.1 Fundamental models of Supervised Learning (Regression, Support Vector Machines, Decision Tree methods, Random Forests) - 4.2 Fundamental models of Unsupervised Learning (k-means Clustering, Hierarchical methods, DBSCAN) with a special emphasis on outlier detection - 4.3 Evaluation of machine learning models
Prerequisites	-
Assessment Methods	- written exam
Recommended Reading and Material	- Géron, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems. O'Reilly Media. - Müller, A. C., & Guido, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists. O'Reilly Media. - Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press. - Matzka, S. (2021). Künstliche Intelligenz in den Ingenieurwissenschaften: Maschinelles Lernen verstehen und bewerten. Wiesbaden: Springer Vieweg.
Attendance	
Comments	

Healthcare and Rehabilitation Technology

Introduction to MATLAB for Applications in Life Sciences

Degree programme	MGR
Semester	2
Course methods	SO
Language	English
ECTS Credits	2
Incoming places	Limited

Course description	This course freely follows the previous introduction to MATLAB for Applications in Life Sciences (MLS1) and furthermore deepens the foundations of selected chapters from the field of life sciences. At the end of the course, students should be able to use MATLAB in their own work for purposes of processing presented signals/biosignals. The course consists of interactive lectures with students solving sample MATLAB problems ranging in difficulty. Individual topics can be introduced into the course setup.
Teaching methods	Interactive lectures about selected topics from the field of Life Sciences, Practical solution of assignments by students supported by lecturer, Project consultations
Learning outcome	After passing this course successfully students are able to ... - Use MATLAB for data manipulation and visualization - Generate signals and perform basic signal operations in MATLAB - Create and use basic digital filters to process signals in MATLAB - Apply gained knowledge and techniques to analyse specific biomedical signals (ECG/EMG etc.)
Course contents	- Signals classification and properties - Operations with signals and signal generation - Design of digital filters - Biosignal analysis
Prerequisites	Basic programming knowledge, General knowledge from Life Sciences on bachelor level
Assessment Methods	- Activity during lectures
Recommended Reading and Material	- V.K. Ingle and J. G. Proakis, Digital Signal Processing Using MATLAB, 1st ed. Pacific Grove, USA: Brooks/Cole Pub. Co., 1999 - A. B. Biran, What Every Engineer Should Know About Matlab and Simulink. New York: Taylor & Francis Group, 2010.
Attendance	Attendance is mandatory, only 20% of absence is tolerated

Data Analysis

Degree programme	MGR
Semester	2
Course methods	SO
Language	English
ECTS Credits	2

Incoming places	Limited
Course description	This course provides a practical introduction to modern data analysis methods. Participants will learn how to prepare and clean data, apply descriptive statistics, and visualize results effectively. The course covers techniques of exploratory data analysis and hypothesis testing and introduces how artificial intelligence can support data processing and interpretation. Finally, participants will explore how to transform analytical results into meaningful written outputs and reports.
Teaching methods	The course combines lectures with hands-on exercises
Learning outcome	After passing this course successfully students are able to ... - Preprocess and clean datasets for analysis - Apply descriptive and exploratory statistical methods - Create clear and informative visualizations - Formulate and test hypotheses using appropriate statistical tools - Use AI techniques to enhance data analysis workflows - Translate analytical findings into coherent and well-structured text
Course contents	- Data Preprocessing and cleaning techniques - Descriptive statistics and data visualization - Exploratory data analysis - Hypothesis formulation and statistical testing - Applications of AI in data processing and analysis - From analysis to text: reporting and interpretation of results
Prerequisites	Basic understanding of statistics and mathematics
Assessment Methods	- exercises - exam
Recommended Reading and Material	-
Attendance	Attendance is mandatory, only 20% of absence is tolerated