

UAS Technikum Wien

COURSE GUIDE WS2026 COURSES OFFERED IN ENGLISH

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Please note:

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

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

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

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

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OVERVIEW OF COURSES OFFERED ENTIRELY IN ENGLISH

Inhaltsverzeichnis

GLOSSARY AND ABBREVIATIONS	11
CAMPUS INTERNATIONAL	13
Campus International	13
CI_Renewable Energy Laboratory	13
CI_From Application to Interview	14
CI_German Language & Austrian Culture A2.....	15
CI_German Language & Austrian Culture A1.....	16
CI_Building Climate Engineering.....	17
CI_Scientific Writing.....	18
CI_Audio Engineering.....	19
CI_German Language & Austrian Culture B2.....	20
CI_Electronic Laboratory	22
CI_Empowering Intercultural Teams for Success: Theory - Tactics – Solutions.....	23
CI_Traffic Safety Culture and Mobility.....	25
CI_German Language & Austrian Culture B1.....	26
Experience Erasmus+: Preparation and Awareness for a Profitable Semester Abroad.....	27
BIP-Cooperative International Student Project (CIP).....	29
Data Ethics & Open Data	30
Building and Solar Energy.....	31
Service and object-oriented Algorithms in Robotics	33
International Marketing	34
Mobile Robotics	35
BACHELOR DEGREE PROGRAMS.....	37
Hydrogen Engineering (BHE)	37
Technical English.....	37
Measurement and Control Technologies.....	38
Measurement and Control Technologies Laboratory.....	39
Computer Science (BIF)	40
Technical English.....	40
IT Security Basics	41
Building Applications with Foundation Models.....	43
Game Development Grundlagen.....	43

Renewable Energies (BEE)	43
Technical English.....	43
Biomass Combined Heat and Power Systems	44
Conventional Power Plant Technology.....	45
Heat Grids Laboratory.....	46
Heat Grids	47
Electricity Grids.....	48
Electricity Grids Laboratory	49
Strategies for Urban Energy Supply	50
Sports Engineering & Ergonomics (BSE).....	51
Technical English.....	51
Biomechanics and Ergonomics Laboratory	52
Mechanical Engineering (BMB)	54
Manufacturing Engineering	54
Materials Science	55
Technical English.....	57
Applied Computer Science.....	58
Business Informatics (BWI)	60
Business Process Engineering	60
Digital Business Planning.....	61
IT Security Basics	62
Scientific Writing and Research Methods.....	64
IT-Based Controlling	65
Software Security.....	66
Tool-Based Data Ops	67
Software Quality & DevOps	68
Backend Web Engineering.....	69
Frontend Web Engineering	70
IT Infrastructure	72
Cloud Computing	73
Machine Learning	74
Data Science Engineering.....	74
Business Simulation Game	75
Creativity & Complexity	77
Rapid Application Development	77
Business Process Engineering	78
Digital Innovation	79
IT Security Basics	80
IT-Based Controlling	82
Software Security.....	83
Rapid Application Development	84
Backend Web Engineering.....	85

Frontend Web Engineering	86
Agile Software Testing	87
Cloud Computing	88
IT Infrastructure	90
Machine Learning	91
Data Science Engineering.....	91
Creativity & Complexity	92
Business Simulation Game	94
Tool-Based Data Ops	95
Mechatronics/Robotics (BMR)	96
Technical English.....	96
Mobile and service robotics.....	97
Electronic Engineering (BEL).....	98
Technical English.....	98
Microcontroller Software Design	99
Technical English.....	100
Microcontroller Software Design	101
Information and Communication Systems and Services (BIC).....	103
Technical English.....	103
Microcontroller Software Design	104
Biomedical Engineering (BBE)	105
Technical English.....	105
Bioinformatics	106
Medical Imaging and Analysis.....	107
Medical Data Engineering 2	108
Biomedical Ex Vivo Models.....	109
Biomedical Engineering Projects.....	110
Current Topics in Life Science Engineering	111
Photonics in Biomedical Engineering	112
Nuclear Medicine and Radiation Protection	112
Web Based Medical Applications	114
Mobile Computing in Medical Applications	115
Methods in Cell & Tissue Engineering	115
Project in Developmental Biology.....	116
Current Cell Technology Approaches	118
Applications of AAT.....	119
Assistive Technologies Plattformen	120
Accessible Webtechnology	121
UX aspects of AAT.....	122
Basics of Assistive Technologies	123
Biomedical in Silico Modeling and Simulation	124
Neurorehabilitation.....	126

Neural Engineering	126
Biomechanics	127
Medical Hospital Equipment.....	129
Sustainable Environmental and Bioprocess Engineering (BUB)	130
Trends in Bioprocess Technology	130
Bioprocess Engineering II	131
Industry-Related Practical Project in Bioprocess Engineering	132
Ecotoxicology.....	133
Green Biotechnology: Climate-Resilient Solutions	134
Industry-Related Practical Project in Environmental Engineering	135
Water, Air and Soil Management	136
Technical English.....	138
Sustainable Environmental and Bioprocess Engineering	139
International Business Engineering (BIW)	140
Manufacturing Engineering	140
Materials Science	141
Technical English.....	143
Industrial Informatics in a Digital Economy.....	144
Circular Economy and Sustainability.....	145
Master DEGREE PROGRAMS	147
Internet of Things and Smart Systems (MIO).....	147
Innovation- and Technologiemanagement	147
IoT System Models	148
Networking.....	150
IoT Operating Systems	151
Mobile and Wireless Systems	152
Data Management	154
Scientific Work	155
Digital Leadership	156
Digital Business Modelling	158
Software Development Processes	159
Advanced Networking	160
App Development	162
Embedded Security.....	163
Sensor Data Analytics.....	164
Automation	165
Advanced IoT Operating Systems.....	166
Advanced IoT Systems Development	167
Medical Engineering & eHealth (MME).....	168
Modelling in Cardiovascular Systems	168
Workflows and Communication.....	170
Digital Leadership	171

Respiration Technologies	173
Advanced Programming for Medicine	174
Medical Information Systems	175
Introduction to MATLAB for Applications in Life Sciences I (Elective Course)	177
Project-Related Teamwork 1	178
Microprocessor Applications in Medicine	179
Cellular Electrophysiology and Bioimpedance.....	180
Company Simulation.....	181
Electromagnetic Compatibility	183
BME for Therapy & Rehabilitation	184
Scientific Skills	185
Sustainability in Life Sciences	185
Ethics.....	186
Image Analysis	187
Biosignal Acquisition and Analysis	188
Clinical Engineering	188
Master Thesis Project	189
Business Modelling	190
Advanced Analysis of Medical Data	190
Innovation and Technology Management (MTM).....	191
Empirical Market Research	191
Innovation and Technology Management	193
Enterprise Simulation.....	194
Digital Leadership & New World of Work	196
Ecotoxicology & Environmental Management (MUT).....	197
Introduction to Ecotoxicology	197
Bioindicators and Biomarkers	198
Endocrine Substances & Endocrine Disruptors.....	198
Healthcare and Rehabilitation Technology (MGR).....	199
Current Topics in Rehabilitation Engineering	199
Wahlfach - Introduction to MATLAB for Applications in Life Sciences I	200
Robotics Engineering (MRE)	201
Advanced Programming	201
Advanced Programming for Robots	202
Industrial Engineering & Business (MIB).....	203
International Finance	203
International Law	204
Professional Writing Skills.....	205
Public Affairs & Lobbying	206
Study Trip abroad 2	207
Quantum Information Laboratory	207
Introduction to Quantum Information.....	208

Enterprise Resource Planning	210
Managerial Economics and Operations Research	211
Data Science (MDS).....	212
AI Requirements Engineering	212
Statistical Computing	212
Business Development & Innovation.....	212
Machine Learning 1: Fundamentals	213
Data Engineering & Visualisation	213
Intercultural Leadership & Management.....	213
Software Engineering Practices in Machine Learning	213
Artificial Intelligence	214
Data Science Ethics.....	215
Data Science Law	216
Quantum Engineering (MQE)	216
Quantum Master Project	216
Quantum Optics & Atom Physics Lab	217
Quantum Programming Lab II	218
Quantum Sensing & Metrology	219
Quantum Computing II.....	221
Quantum Optics & Atom Physics	222
Homologation Electronics	223
Quantum Programming Lab I.....	224
Homologation Computer Science.....	225
Homologation Physics	226
Quantum Information I	226
Quantum Computing I.....	227
Enabling Technologies I.....	228
Mathematics for Quantum Engineering.....	229
Team Performance and Leadership.....	230
Information Systems Management (MWI).....	231
Digital Supply Chain Applications.....	231
Systems Engineering	232
Knowledge and Document Management	233
IT-Governance (ITIL, Cobit)	234
Renewable Energies (MEE)	235
Investment and Financing.....	235
Control Technology.....	237
Innovation and Technology Management	238
Energy Storage Technologies.....	239
Introduction to Modelling and Simulation.....	240
Specialization Focus Definition and Scientific Methods.....	242
Ethics in Technology.....	243

Ecology and Society	244
Life Cycle Analysis	245
Energy and Environmental Law	246
Digital Leadership	247
Master Project.....	249
Current Topics in Renewable Energy Supply	250
Supply and Demand Side Management.....	252
Process Optimization	253
Sports Technology (MST).....	254
Biomechanical Multibody Simulation.....	254
Materials Science in Sports Technology	255
Mechanical Calculations in Sports Technology	256
Applied Biomechanics.....	257
Rapid Prototyping Project	258
Aerodynamics	259
Bionics	260
LCA and Green Design in Sports Technology.....	261
Statistics and Qualitymanagement.....	261
Sports Practice Measurement Week - Winter.....	261
Rapid Prototyping	261
Tissue Engineering and Regenerative Medicine (MTE)	262
Biomaterials in Tissue Engineering	262
Stem Cell Basics.....	263
Corporate Management	264
Sustainability and Ethics in Work and Engineering	265
Molecular and Cellular Biology in Regenerative Medicine	266

GLOSSARY AND ABBREVIATIONS

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

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

International Business Engineering	BIW
Business Informatics	BWI
Master	
Medical Engineering & eHealth	MME
Data Science	MDS
Renewable Energies	MEE
Health Care and Rehabilitation Technology	MGR
Industrial Engineering & Business	MIB
Robotics Engineering	MRE
Quantum Engineering	MQE
Sports Technology	MST
Tissues Engineering and Regenerative Medicine	MTE
Internet of Things and Smart Systems	MIO
Innovation and Technology Management	MTM
Information Systems Management	MWI

CAMPUS INTERNATIONAL

Campus International

CI_Renewable Energy Laboratory

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Experimental setup of different means of measuring methods to evaluate the performance of renewable energy technologies and systems.
Teaching methods	Laboratory exercises in small groups of typically 8-12 students
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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_From Application to Interview

Degree programme ECI

Semester 1

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 Lecture Exercises and group exercises Writing workshop Interview 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	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description Based on the A1 course we train frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). The course will teach frequently used expressions related to very basic personal and family information, shopping, local geography, employment. indefinite pronouns

Teaching methods group work, role play, text production, homework

Learning outcome After passing this course successfully students are able to ...
- understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need

Course contents

- Grammar: regular and irregular verbs in Perfect, prepositions with Akkusativ+Dativ, separable verbs
- Topics: Living together, Looking for an apartment, Furniture, clothes, Sights, Arts, Basic information about Austrian culture

Prerequisites A1

Assessment Methods

Recommended Reading and Material - PANORAMA, Deutsch als Fremdsprache A21, Kursbuch, Cornelsen Verlag; ISBN 978-3-06-120488-4 (also available as E-Book)/ PANORAMA Übungsbuch A2.1; ISBN 978-3-06-120604-8

Attendance

Comments

CI_German Language & Austrian Culture A1

Degree programme ECI

Semester 1

Course methods ILV

Language English

ECTS Credits 3.00

Incoming places Limited

Course description Starting from a very basic level of German (A1 of the Common European Framework of Reference for Languages), we aim at developing students for situations required for personal and social interaction in Austria on a basic level. The focus of the course is the development of oral communication skills within an intercultural context.

Teaching methods discussions, integrative grammar work, role games, songs, group work and presentations

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

- ask questions about personal details
- talk about themselves and others in terms of hobbies, preferences, dislikes
- understand and write short e-mails, using an appropriate level of formality
- understand and formulate simple questions and orders
- understand and use numbers in various contexts as well as to ask for prices, such as in the furniture store, in the restaurant, at the Christmas market
- give the time of day and make appointments
- understand and use the phrases required for shopping and eating out as well in daily situations

	<ul style="list-style-type: none"> - talk about living circumstances as well as the weather and ask questions - talk and write about the past
Course contents	<ul style="list-style-type: none"> - personal topics - vocabulary and situations in terms of eating and drinking, living circumstances - weather - oral and written situations in the past (past perfect tense) - integrative grammar: articles in nominative and accusative, possessive pronouns in nominative and accusative, past perfect tense, prepositions, imperative, modal verbs
Prerequisites	Basic knowledge in German language (GERS A1) such as ABC, numbers, conjugation of the verbs, articles, forms of negation, basic vocabulary is advantageous
Assessment Methods	- 20% personal language development; 30% tests during the semester; 50% final exam (written exam and presentation)
Recommended Reading and Material	- Scriptum and online-exercises
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_Building Climate Engineering

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Theoretical and practical basics of Building Energy Design: energy efficient constructions, building physics, heating, ventilation and air conditioning of energy efficient buildings in Austria and internationally.
Teaching methods	Lectures combined with practical teaching on the construction site of

an energy efficient building.

Learning outcome

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

- analyze different building construction components, facades and window concerning their energy efficiency, comfort and building physics,
- design preliminary concepts of energy efficient projects,
- overview possibilities of ventilation, heating and cooling,
- compare different construction techniques concerning energy efficiency, building quality and comfort, especially related to their home country.

Course contents

- Basics of building physics, heat, humidity and sound protection
- Building construction components from the view point of building physics and energy efficiency, comparison on international basis
- Heating, cooling and ventilation possibilities,
- Energy benchmark levels, calculating of the energy demand of buildings

Prerequisites

Basic knowledge at least in one or two of the following topics: - Building construction- Building physics - Heating, ventilation and air conditioning - Energy planning of buildings

Assessment Methods

- Combined written and oral exam, written exam in 2-3 examples 40% Cooperation, attendance 20%
- Project including energy layout and a short planning example of heating, ventilation and/or cooling 40%

Recommended Reading and Material

- Gerhard Hausladen, Saldanha, Liedl, 2013: Climate Skin Building Skin Concepts that can do more with less energy, ISBN978-3-0346-0727-8, Birkhäuser Verlag Basel

Attendance

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

Comments

CI_Scientific Writing

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

Incoming places	Limited
Course description	This hands-on-course dives deep into the praxis of scientific writing. Theory and basics of scientific writing are subjects of online learning, while the meetings are used to practice, analyse und discuss your own scientific writing.
Teaching methods	Exercises, peer-learning, talks, discussions, online-tasks
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Leedy, Ormrod: Practical Research. Planning and Design. Pearson - Skern: Writing Scientific English. Facultas wuv UTB
Attendance	Attendance is partly mandatory in this course. You can attend every class, and should at least participate in two sessions (50%) after the Kick-off.

Comments

CI_Audio Engineering

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

Course description	This integrated course provides students the opportunity to familiarise themselves with the basics of acoustics and audio engineering, including perception of sound, microphones, amplifiers, loudspeakers, audio processing, etc.
Teaching methods	The Lecturer will explain some basic concepts. The students will complete tasks in the computer using Matlab.
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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 - Loudspeakers09
Prerequisites	Basic programming skills. Matlab knowledge advantageous.
Assessment Methods	- The students will be assessed according to how far they completed the task at hand
Recommended Reading and Material	- Script provided by the lecturer
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	

CI_German Language & Austrian Culture B2

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Repetition, perfection and exercises of relevant grammatical structures • Vocabulary and useful phrases for B2 • Economy / career / work • New technology • Modern life / society
Teaching methods	Normal class with presence (15 UE): Discussions, work in large and small groups and presentation of your results you have prepared in form of a short text. AND E-learning with Moodle (15 UE): Single work with deadline for interim reports, exercises on reading, grammatical issues and vocabulary, writing 3 short texts (400 words each) and revision of the 3 texts.
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - understand grammatically complex texts which are rich in vocabulary on the level B2 - write a summary and comment the main topics of a text. <p>Furthermore you have developed and enlarged your knowledge of German for the purpose of your studies</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Reading of press articles and exercises in global and close reading as well as training of vocabulary and grammar - Writing summaries and expressing your point of view with the right expressions - Expressing advantages or disadvantages - Writing a letter of complaint or a request with the right expressions - Reporting about texts, describing and commenting graphics in the context of an article - Making an interview in the context of your studies and writing about your learning outcome
Prerequisites	Only for students with a good knowledge of German who are

interested in improving their writing skills

Assessment Methods

- 1) 3 texts Option A Writing a summary and a comment on 3 long newspaper articles (1 with graphics) in the amount of about 400 words. OR Option B: Writing a summary and comment on 2 long newspaper articles (1 with graphics) in the amount of about 400 words and make a study-specific interview with a person of your interest, write a transcription/summary and reflect about your learning outcome. (50 points)
- 2) Exercises on Moodle (25 points)
- 3) Active participation (25 points)

Recommended Reading and Material

- Texts and exercises on Moodle and handouts of the regular class.

Attendance

Compulsary

Comments

CI_Electronic Laboratory

Degree programme

ECI

Semester

1

Course methods

ILV

Language

English

ECTS Credits

3.00

Incoming places

Limited

Course description

This integrated course provides students the opportunity to calculate and build electronic circuits, as well as measuring their characteristics with modern measuring devices.

Teaching methods

The Lecturer will explain briefly the basic concepts students need to know to perform the experiment at hand. The students will work in groups to perform the experiment. The Lecturer will be available to assist the students in building and measuring their experiment, as well as to clarify any questions and solve any problems that may arise in the process.

Learning outcome

- After passing this course successfully students are able to ...
- measure voltages and currents with a DMM and oscilloscope correctly
 - produce signals with the Function Generator
 - calculate electronic circuits, build them and measure their outputs

and characteristics

- measure the output of circuits involving resistors, capacitors, diodes and OpAmps with the oscilloscope

Course contents

- Oscilloscope and Function Generator
- Kirchhoff laws
- Diode and Zener Diode
- DC Power supply design and implementation
- OpAmp circuits
- RC Circuit: DC and AC analysis
- Transistor Amplifiers
- Project: Audio Equaliser

Prerequisites

Students should have basic knowledge of electronics and electronic circuits.

Assessment Methods

- The students will be assessed according to how far they completed the experiment at hand.

Recommended Reading and Material

- Maxfield et al., "Electrical Engineering know it all", Newnes & Elsevier, 2008.
- Scripts and materials provided by the lecturer.

Attendance

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

Comments

CI_Empowering Intercultural Teams for Success: Theory - Tactics – Solutions

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

Course description

Simply, the purpose of this course is to help you enhance your employability and further the development of your career prospects. In an increasingly inter-cultural and dynamic world what will be the skills that stand out to attract employers? Intercultural awareness, the ability to work in multi-cultural teams, the ability to demonstrate awareness and agility and the ability to work in an English

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

Teaching methods

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

Learning outcome

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

- question their culturally formed stereotypes and prejudices;
- reflect on different strategies for dealing successfully with cultural differences;
- apply strategies to overcome problems related to intercultural differences;
- work successfully in an English as a Lingua Franca environment;
- cooperate effectively in intercultural teams to overcome and solve cultural problems and issues.

Course contents

- Attributes of a successful intercultural team participant/leader;
- Hofstede's cultural dimensions;
- Techniques for efficient communication in English as a Lingua Franca;
- Strategies for working successfully in an intercultural team;
- Problem based intercultural workshop

Prerequisites

B2 English level

Assessment Methods

- 25% student presentation
- 50% successful completion of workshop
- 25% final written task

Recommended Reading and Material	- Script
Attendance	75% mandatory
Comments	

CI_Traffic Safety Culture and Mobility

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

Course description This integrated course provides insights to theoretical background and practical issues of national, regional and local aspects of traffic safety culture and mobility in the Vienna region as well as human factors in transportation and mobility.

Teaching methods Mandatory readings, individual investigation, presentations and group discussions in plenum and breakout sessions. Some frontal teaching.

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

- explain the concept of traffic safety culture and practically apply it to plan their mobility, safely and efficiently travel to all relevant points of interest
- understand local particularities and consider them for a safe movement during their stay in Vienna and beyond
- gain basic understanding of important psychological concepts relevant for research of human factors in mobility (technology acceptance, emotions & aggression, perception). Those concepts can be operationalized and measured, thus considered for the students' own research

Course contents - Applied: The concept of traffic safety culture and its application to any place in the world, in particular to the Vienna region. Planning trips using all modes from the most individual (bicycle, e-scooter) to the to the most public means of transport (bus, underground, train). Practical aspects from buying tickets to some of the strangest traffic rules in Austria. Acquisition of a driving license as well as use of

shared vehicles. Points of interest from administration to sports.
 Theory and Research: •Elaboration of different concepts of traffic safety culture and their application in different professional contexts. Operationalization and measurement of traffic safety culture as well as intervention strategies on different levels (example of local road safety culture). •Human factors in the context of increasing vehicle automation: cooperation between driver and vehicle, new 'driving' skills (monitoring, vigilance), driver training of the future, ethical dilemmas •Acceptance of new technology: different types of adoptions, influencing factors and how to measure acceptance •Aggression in traffic: why can traffic be so hostile? Genesis, contributing and mitigating factors

Prerequisites	None
Assessment Methods	- Reports on mandatory readings (30%) - active participation (30%) - Exam
Recommended Reading and Material	- Ward, N. J., Watson, B., & Fleming-Vogl, K. (Eds.). (2019). Traffic Safety Culture: Definition, Foundation, and Application. Emerald Group Publishing. - Shinar, D. (Ed.). (2017). Traffic safety and human behavior. Emerald Group Publishing. - Journal Transportation Research Part F - Journal of Transportation and Health
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.

Comments

CI_German Language & Austrian Culture B1

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This integrated course provides the linguistic skills to deal with most

situations likely to arise whilst you are staying in Austria. You will be prepared to enter into conversation on topics that are familiar, of personal interest or pertinent to everyday life (e.g. family, hobbies, work, travel and current events).

Teaching methods	Group work, role plays, text production, excursion, audio- and video files, authentic texts
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Topics: Family life, contacts, men and women today, work environment, travelling and traffic, nature and environment - Grammar: Subordinate clauses, adjective+article, infinitive construction, Tenses, reflexive pronouns, subjunctive I +II, passive voice
Prerequisites	German A2 level
Assessment Methods	- Tests (mid-term and final test,) performance in class, homework
Recommended Reading and Material	
Attendance	80%
Comments	

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

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

Course description	Do you want to study abroad and do you want to get the most out of your time studying abroad? Then this course is for you! Here, we will be examining cultural differences and how to work with them as well as ways in which universities and systems of education can differ across countries and how to negotiate these differences. This will be a highly interactive course: I will be presenting key aspects of intercultural theory and you will be presenting study experiences in specific countries and working through case studies together. There will also be many opportunities to improve your communication skills in English as a medium of communication (by learning suitable strategies) and also many opportunities to work with and get to know other international students. The course has been running successfully for one semester and I have lots of ideas to make it even more useful and absorbing in the coming semester!
Teaching methods	Theoretical input, group workshops, teamwork, group discussions, independent research, participant preparation of written documents.
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 50% student presentations - 25% completion of participation tasks - 25% final written task
Recommended Reading and Material	- Script

Attendance 75% mandatory
Comments

BIP-Cooperative International Student Project (CIP)

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

Course description The main focus of the specialization 'Cooperative International Project-Smart Cities' follows the integrated design of urban projects under consideration of technological options (energy, buildings, networks), design options (architecture in urban areas) and user behaviour (diversity). Through the integration of interdisciplinary and international teams the project gains additional benefit. Compared to the specialisation of the 4th semester technological options, geographic area and user behaviour get complexer.

Teaching methods project work with international teams

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

- solve integrated planning, design, construction and development procedures in the international context of a smart city
- discuss and evaluate the interdisciplinary aspects of energy supply and demand, architecture and city planning for building complexes
- analyse and integrate gender and diversity aspects in the international context of a smart city project
- integrate measures and data analysis of international reference projects in the own project
- formulate and state a problem of the respective discipline and write a scientific bachelor thesis adhering to a given template
- explain and present the contents and results of their own scientific publications and those of others

Course contents - International Team work of an integrated planning process of a large SMC project, for instance a district in urban areas. Consequent procedure of characteristic project phases, requirement specifications, project plan, design concepts, variants,

documentation and presentation. Integration of diversity aspects in the smart city context. Usage of complex simulation software. Contact with regional, urban administration officials.

Prerequisites	Basics in at least two sectors: building construction, electrical and/or mechanical installations, energy design and solar architecture
Assessment Methods	- Course immanent assessment method with a final presentation in front of an international commission
Recommended Reading and Material	- Transform, Transformation Agenda for Low Carbon Cities, 2013, http://urbantransform.eu
Attendance	Attendance ist mandatory
Comments	this project will be realised in cooperation of international University teams

Data Ethics & Open Data

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

Course description Open data is accessible public data that people, companies and organisations can use and process. The benefit of Open Data is not only the publication itself, but especially its duplication and reuse as new applications and solutions can increase transparency, promote innovation and encourage community engagement. The extensive use of increasingly more data in general also requires the consideration of complex moral and ethical subjects related to data to support good solutions and responsible handling. The course will be divided into two subject areas: Lectures on Data Ethics will provide the opportunity to learn about the ethical impacts of data and related topics (privacy, transparency, surveillance etc.). In lectures on Open Data students will learn about Open Data from a technical viewpoint and work on an Open Data application.

Teaching methods The course consists of - lectures combined with discussions - project work and exercises

Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - analyse and work with Open Data - determine different fields of Open Data applications - assess the quality of different Open Data sources - value 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Participation in discussions and presentation (Data Ethics) - Project results and project presentation (Open Data)
Recommended Reading and Material	<ul style="list-style-type: none"> - 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.

Building and Solar Energy

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	Design of a solar system for a housing complex including technical parameter, contribution to the local electricity system including

heating and mobility needs; economic calculation, ecologic impact.

Teaching methods

Project-Based Learning method. Combined with lectures and practical teaching on the remote laboratories. Supported by virtual learning environment and simulation.

Learning outcome

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

- Design preliminary concepts and design of energy efficient building supported by solar energy
- Simulation of a solar energy system
- Possibilities of building integrated photovoltaics and construction design
- Overview of the market, drivers, stakeholders for integration of affordable renewable energy systems

Course contents

- Energy characterization and energy planning of solar building
- Designing a building-integrated photovoltaic installation by software tools
- Measurement and analysis of solar systems in the lab
- Best practice of solar design (Excursion)
- Overview of the market, legislative and drivers for solar energy and buildings

Prerequisites

Basic knowledge at least in one or two of the following topics: - Building construction - Solar energy system - Energy planning of buildings

Assessment Methods

- Lecture notes
- Grading of practical session
- Project reports

Recommended Reading and Material

- Cost Optimal and Nearly Zero-Energy Buildings (nZEB) Definitions, Calculation Principles and Case Studies, Editors: Kurnitski, Jarek (Ed.)
- Designing with Solar Power: Source book for Building Integrated Photovoltaics. D. Prasad, 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

Service and object-oriented Algorithms in Robotics

Degree programme	ECI
Semester	1
Course methods	ILV
Language	English
ECTS Credits	6.00
Incoming places	Limited
Course description	The course discusses important concepts of robot control in the context of modern data-driven robotics. Thus, different methodologies from robotics and data-science are taught and utilised using Python and the robot operating system (ROS).
Teaching methods	This course is based on theory and exercises with mobile robot simulations/ robots. - Lecture (theory, methods, math and algorithms) - Exercises in small groups: problem solving with robot simulation/ real robots
Learning outcome	After passing this course successfully students are able to ... - explain components and operating modes of robots, - define and differentiate between navigation with plans, localisation and trajectory planning, - identify required robot system components based on the system's desired use case and level of autonomy, - create ROS launchfiles and interface with ROS using Python and Jupyter notebooks, - implement pipelines for sensor data processing, and - explain and visualise various data types/structures required in robotics applications.
Course contents	- Introduction to important concepts in robotics and ROS - Sensor-based robot control - Mobile robot simulation - Programming and software documentation (Python and Jupyter notebooks)
Prerequisites	Mandatory: - Sensor technology - Basic understanding of programming, in particular in Python or C

Assessment Methods	- 70% Group project with presentation - 30% Exercises
Recommended Reading and Material	- http://wiki.ros.org/ROS/Tutorials - C. M. Bishop, Machine Learning and Pattern Recognition, 2006 - S. Russell and P. Norvig, Artificial intelligence: a modern approach, 1995
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the exam.
Comments	-

International Marketing

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

related with it

- evaluate the factors to consider when choosing a market entry strategy
- design global marketing programs
- contribute to strategic marketing decisions
- understand and contribute to marketing mix decisions

Course contents

- Internationalization process
- Market segmentation
- Creating competitive advantage
- Global marketing communication
- Market selection process
- Brand building
- Marketing Mix decisions

Prerequisites

none

Assessment Methods

- Written examination (70%)
- Group Assingment (30%)

Recommended Reading and Material

- Global Marketing, Hollensen, 2016
- International Marketing, Czinkota , Ronkainen 2012
- Strategic Brand Management, Keller 2013

Attendance

Attendance is compulsory.

Comments

Detailed information regarding the course is provided via Moodle.

Mobile Robotics

Degree programme

ECI

Semester

1

Course methods

ILV

Language

English

ECTS Credits

6.00

Incoming places

Limited

Course description

The course provides an introduction to the basics in mobile robotics with regard to essential mobile robot components. Students achieve a basic understanding of methods to control mobile robots by implementing behaviours as well as methods for direct sensor-actor coupling.

Teaching methods

This course is based on theory and practical exercises/projects using

simulation of mobile robots. The first classes are supported by a theory lecture (theory, methods, mathematics and algorithms) and guided exercises before students solve project tasks in small groups (solving various problems arising in robot control in simulation/on real robots).

Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 70% Group project with presentation - 30% Exercises
Recommended Reading and Material	<ul style="list-style-type: none"> - http://wiki.ros.org/ROS/Tutorials - R. Siegwart and I.R. Nourbakhsh and D. Scaramuzza, Introduction to autonomous mobile robots, 2011 - C. M. Bishop, Machine Learning and Pattern Recognition, 2006
Attendance	Attendance is mandatory in this course, only 20% of absence is tolerated. In case you miss more than 20% of the class you lose the first try in the semester project.
Comments	This course requires a (reasonably) powerful computer:- min i5 (7th gen.)- 8GB RAM (Ubuntu) 16GB RAM (Windows)

BACHELOR DEGREE PROGRAMS

Hydrogen Engineering (BHE)

Technical English

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

Course description In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion

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

- record and employ technical vocabulary
- create and understand technical process instructions
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)

Course contents

- Understanding the importance of English in international technical communication
- Technical product descriptions
- Technical process descriptions
- Analysing and describing the impacts of technologies
- Formal writing and paragraph construction

Prerequisites B2 level English

Assessment Methods	<ul style="list-style-type: none"> - Vocabulary Test (10%) - Self-Study and Class Preparation (30%) - Written Test (60%)
Recommended Reading and Material	<ul style="list-style-type: none"> - Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Measurement and Control Technologies

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

Course description In this course, students learn the fundamentals of control engineering, taking into account system identification, controller design, and stability analysis in linear and switching control loops with SISO (single input, single output) systems. Furthermore, state-based control for linear MIMO (Multiple Input, Multiple Output) systems and the fundamentals of measurement technology are covered.

Teaching methods

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

- Feedforward and feedback control systems
- Structure of control loops, signal flow plan
- SISO (Single Input, Single Output) and MIMO (Multiple Input, Multiple Output) systems
- Representation in time and frequency domain
- System identification, stability
- Switching controllers (two-point / three-point)
- Design of P, I, PI, PD and PID controllers
- Represent a linear MIMO system in the state space
- Calculation of basic operational amplifier circuits

Course contents	<ul style="list-style-type: none"> - Feedforward and feedback control systems - Structure of control loops, signal flow plan - SISO (Single Input, Single Output) and MIMO (Multiple Input, Multiple Output) systems - Representation in time and frequency domain - System identification, stability - Switching controllers (two-point / three-point) - Design of P, I, PI, PD and PID controllers - State-based control systems - Calculation of basic operational amplifier circuits
Prerequisites	Contents of the first two semesters
Assessment Methods	- Course-immanent performance assessment, exam
Recommended Reading and Material	<ul style="list-style-type: none"> - P. Busch, Elementare Regelungstechnik: Allgemeingültige Darstellung ohne höhere Mathematik, 8. Auflage, 2012, Vogel Buchverlag, ISBN 978-3-8343-3284-4 - K.-D. Tieste, O. Romberg, Keine Panik vor Regelungstechnik!, 3. Auflage, 2015, Springer Vieweg, ISBN 978-3-658-06348-1 - Zacher, S. & Reuter, M., 2011. Regelungstechnik für Ingenieure., 13. Auflage. Wiesbaden: Vieweg+Teubner Verlag - Mühl, Thomas. Elektrische Messtechnik: Grundlagen, Messverfahren, " Anwendungen. 6th ed. 2020., 2020 - Czichos, Horst. Mechatronik: Grundlagen und Anwendungen technischer Systeme. 4th ed. 2019., 2019 - R. Patzelt, H. Schweinzer, 1996. Elektrische Messtechnik Springer Wien - Bentley, John P., 2005. Principles of measurement system (4th ed.) Pearson Education Limited
Attendance	mandatory
Comments	

Measurement and Control Technologies Laboratory

Degree programme	BHE
Semester	3
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	Based on the theoretical knowledge from the course Measurement and Control Technologies, various experimental setups on measurement and control technologies are implemented in the laboratory.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - to model and simulate control loops in Matlab/Simulink - to implement control loops and investigate their response to setpoint deviations and disturbances - to simulate various basic types of controllers (P, PI, PID controllers) and measure them in the laboratory
Course contents	<ul style="list-style-type: none"> - control systems - types of controllers (P, PI, PID) - transfer functions - fundamental components of control systems
Prerequisites	content of the first two semesters
Assessment Methods	- protocols
Recommended Reading and Material	
Attendance	mandatory
Comments	

Computer Science (BIF)

Technical English

Degree programme	BIF
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical

vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods

small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion

Learning outcome

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

- record and employ technical vocabulary
- create and understand technical process instructions
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)

Course contents

- Understanding the importance of English in international technical communication
- Technical product descriptions
- Technical process descriptions
- Analysing and describing the impacts of technologies
- Formal writing and paragraph construction

Prerequisites

B2 level English

Assessment Methods

- Vocabulary Test (15%)
- Self-Study and Class Preparation (25%)
- Written Test (60%)

Recommended Reading and Material

- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag.
- Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.

Attendance

Obligatory

Comments

IT Security Basics

Degree programme

BIF

Semester

3

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	Integrated course
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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 - distinguish between different types of malware. - list methods for access control and monitoring at network, system and application levels and explain their function and application scenarios - explain basic technologies for secure communication - describe and recognise various methods of social engineering.
Course contents	<ul style="list-style-type: none"> - 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 - Malware - Social Engineering
Prerequisites	Infrastructure Basics
Assessment Methods	- Course immanent assessment method and final exam
Recommended Reading and Material	- Stallings, W., Brown, L. (2015). Computer security: Principles and practice. Harlow, United Kingdom: Pearson.
Attendance	required

Comments

Building Applications with Foundation Models

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

Game Development Grundlagen

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

Renewable Energies (BEE)

Technical English

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

Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process
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descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	<ul style="list-style-type: none"> - Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	<ul style="list-style-type: none"> - Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	<ul style="list-style-type: none"> - Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Biomass Combined Heat and Power Systems

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

Course description	Bioenergy supply with focus on combined heat and power technologies
Teaching methods	Integrated course with presentations and project work
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - to design the processes and main components of biomass CHP plants - assess and evaluate biomass CHP conversion technologies and their main usage: steam processes, organic rancine cycle processes (ORC), gas engines - assess and evaluate the operation procedure of heat and/or power driven biomass CHP plants - describe the energetic utilization possibilities of biomass through different conversion routes
Course contents	<ul style="list-style-type: none"> - Engineering of components and thermal process design of biomass CHP plants - Biomass steam turbine plants - Biomass ORC plants - Biomass gas engines - Production of biogenic fuels for the respective biomass technologies
Prerequisites	Basics in Physics, Thermodynamics and Thermal Biomass utilisation
Assessment Methods	- Presentations, test, and project work
Recommended Reading and Material	<ul style="list-style-type: none"> - Kaltschmitt, Hartmann, Hofbauer (2016): Energie aus Biomasse, Springer VDI Verlag - Schmitz, Schaumann (2010), Kraft-Wärme-Kopplung, Springer VDI Verlag - Obernberger et al. (1999): Dezentrale Biomasse Kraft Wärme Kopplungstechnologie, Bios Verlag
Attendance	75 %
Comments	

Conventional Power Plant Technology

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

Incoming places	Limited
Course description	Basics of gas combined cycle gas turbines
Teaching methods	Flipped Classroom: theory tests and final exam
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - to analyze gas combined cycle gas turbines processes - analyse measures for the most efficient use of energy - analyse thermodynamic processes - propose best operation mode, heat or electricity related, for most efficient use - evaluate and critically scrutinize CO₂ capture measures - propose measures for combined operation with renewable energy sources and with sustainable fuels
Course contents	<ul style="list-style-type: none"> - Thermodynamic fundamentals of the Joule/Brayton cycle and the Clausius Rankine cycle - Basics and in-depth analysis of combined cycle gas turbines - Realistic design of combined cycle gas turbine's components and integration into energy systems - Carbon capture and storage technologies for CO₂ separation - Future directions of combined cycle power plants and the role of hydrogen and synthetic fuels
Prerequisites	Basics in Physics and Thermodynamics
Assessment Methods	- Theory tests and final exam
Recommended Reading and Material	<ul style="list-style-type: none"> - Zahoransky (2015): Energietechnik, Springer Vieweg Verlag; - Strauß (2016): Kraftwerkstechnik, Springer Verlag;
Attendance	75 %
Comments	

Heat Grids Laboratory

Degree programme	BEE
Semester	5
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	Measurement exercises concerning simulation, load behaviour and systemic integration of plants for urban heating and cooling supply
Teaching methods	•Preparation for exercise through self-study (Moodle-Test)•Presentation of the laboratory exercise and exercise in groups•Recording of measured values•Writing of a laboratory report
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - measure and analyse the main characteristics of transfer stations for heating and cooling supply under laboratory test conditions - configure and simulate thermal networks - optimise thermal networks in laboratory tests with regard to load behaviour and to subject them to an economic analysis - analyse the tasks of the load distributor of an urban heating and cooling supplier
Course contents	<ul style="list-style-type: none"> - Safety instructions, laboratory regulations, protocol guidelines - Transfer stations for heating and cooling supply, - Simulation of thermal networks, - Load behaviour of thermal networks and evaluation with regard to technical-economic-ecological assessment - Laboratory excursion: load distributor, heating and cooling supply
Prerequisites	Basics in mechanical engineering, M2.3 Electrical engineering 2, M2.1 Thermodynamics
Assessment Methods	- Laboratory report and active participation
Recommended Reading and Material	<ul style="list-style-type: none"> - Schäfer (2013): Fernwärmeversorgung, Springer - Cube, Steimle, Lotz (1997): Lehrbuch der Kältetechnik Band 1 und 2, Verlag: Hüthig Jehle Rehm; Auflage: 4. Aufl.
Attendance	100 %
Comments	

Heat Grids

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

Course description	Basics in thermal grids with focus on district heating and cooling
Teaching methods	Integrated lecture and exercise project
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - describe the main components of energy grids for district heating and cooling - describe the function and the operation of thermal energy grids - calculate the main parameters of thermal energy grids - describe the systems effects between producer and supplier on the operation of energy grids for district heating and cooling - describe the function and the operation of energy grids under consideration of renewable energy integration - calculate and simulate in an easy way the operation of thermal energy grids
Course contents	<ul style="list-style-type: none"> - Structure of district and cooling networks - design parameters of thermal grids - techn.-econ.-ecol. efficiency parameters of thermal grids - heating/cooling transfer station - economic parameters - Consumer analysis and decentralised thermal grid design - Thermal grids under EU/A conditions, responsibility of grid operators, Effect of decentralised energy on grid quality, new solutions for the operation of distribution networks - Potentials of district cooling in EU/A, integration of district cooling in large heating networks, ecological effects of district cooling, technical aspects of district cooling, market and costs;
Prerequisites	Basics in Physics and Thermodynamics
Assessment Methods	- exercise project of a grid simulation and final examination
Recommended Reading and Material	<ul style="list-style-type: none"> - Schäfer (2013): Fernwärmeversorgung, Springer - Cube, Steimle, Lotz (1997): Lehrbuch der Kältetechnik Band 1 und 2, Verlag: Hüthig Jehle Rehm; Auflage: 4. Aufl.
Attendance	75 %
Comments	

Electricity Grids

Degree programme	BEE
Semester	5
Course methods	ILV

Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The electrical networks module gives a practical overview of the design and operation of electrical networks (in urban areas) from a systemic point of view.
Teaching methods	Integrated lecture
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - describe the main components of energy grids for electricity, - describe the function and the operation of the electricity grid, - calculate the main parameters of electricity grids - describe the systems effects between producer, supplier and storages on the operation of electricity grids - describe the function and the operation of electricity grids under consideration of renewable energy integration - calculate and simulate in an easy way the main parameters (current, voltage, power) of electric energy grids
Course contents	<ul style="list-style-type: none"> - Structure of el. grids, main parameters, switch gears, measuring transformers, transformer and controller, power lines, safety components; - Integration of renewables in electricity grids - El. grids under EU/A conditions, responsibility of grid operators, Power Quality, Effect of decentralised energy on power quality, new solutions for the operation of distribution networks; - Simulation of distributed networks
Prerequisites	<ul style="list-style-type: none"> • Electrical engineering 1 and 2 • Electrical Power Engineering • Thermodynamics
Assessment Methods	
Recommended Reading and Material	<ul style="list-style-type: none"> - Hosemann (2000): Elektrische Energietechnik, Bd3 Netze, Springer - Schwab (2011): Elektroenergiesysteme, Erzeugung, Transport, Übertragung und Verteilung elektrischer Energie, Springer Verlag - Graebig et al (2023): STROM, NETZ, FLUSS: Ein Atlas unserer Stromwelt und ihres Wandels (https://stromnetzfluss.de/)
Attendance	75 %
Comments	

Electricity Grids Laboratory

Degree programme	BEE
Semester	5
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description In the Electrical Networks Laboratory module, the contents imparted in the "Electrical Networks" and "Energy Generation Systems" modules are applied with practical exercises in the laboratory.

Teaching methods

- Preparation for exercise through self-study (Moodle-Test)
- Presentation of the laboratory exercise and exercise in groups
- Recording of measured values
- Writing of a laboratory report

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

- to measure and interpret the energetic performance of components of energy generation, storage, consumption and conversion

Course contents

- Experimental setup of the most important metrological procedures for assessing the quality of machines and systems for energy conversion
- Knowledge of solving measurement tasks
- Metrological analysis and evaluation of the energetic performance of energy conversion components
- Metrological analysis and evaluation of the energetic performance of heat pump systems, photovoltaic systems

Prerequisites

- Electrical networks
- Automation 1
- Power generation plants

Assessment Methods

Recommended Reading and Material

- Hosemann (2000): Elektrische Energietechnik, Bd3 Netze, Springer
- Schwab (2011): Elektroenergiesysteme, Erzeugung, Transport, Übertragung und Verteilung elektrischer Energie, Springer Verlag

Attendance 100 %

Comments

Strategies for Urban Energy Supply

Degree programme	BEE
Semester	5

Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Concepts of the current energy supply in cities and strategies for the future.
Teaching methods	project work
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - comment the background of urban energy strategies - give examples for environmentally friendly urban energy strategies - give best practise solutions for urban energy strategies
Course contents	<ul style="list-style-type: none"> - Basics in urban energy strategies; - best practises of urban energy supply, - potentials of renewable energies in urban areas, - legislation concerning urban energy strategies, - presentations of selected guest lecturers
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	75 %
Comments	

Sports Engineering & Ergonomics (BSE)

Technical English

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

toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	<ul style="list-style-type: none"> - Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	<ul style="list-style-type: none"> - Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	<ul style="list-style-type: none"> - Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Biomechanics and Ergonomics Laboratory

Degree programme	BSE
Semester	3
Course methods	LAB

Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description The recording and analysis of human movement is a central element in biomechanics and ergonomics and in the evaluation of the interaction between sports equipment and athletes. In this laboratory exercise, students learn the biomechanical and technical fundamentals of common motion analysis systems as well as how to conduct measurements with them. In addition to data collection, student will learn how to evaluate motion analysis data and document their results in accordance to scientific standards.

Teaching methods In preparation for each lab session, students will self-reliantly work through measurement system specific self-study material to familiarize themselves with biomechanical and technical fundamentals as well as the objective / protocol of the ensuing lab session. During the lab sessions, students will learn to carry out measurements by conducting biomechanical experiments. In small groups students will be both participants and test operators. Lecturers will introduce students to the measurement system and support them while they self-reliantly carry out measurements. In distinct data treatment sessions, lecturers will support the students in evaluating the previously acquired data. Each group will then document their findings in accordance to the requirements of a results section of a scientific paper.

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

- carry out measurements with three-dimensional force plates and analyze ground reaction forces.
- carry out motion analyses using 2D video analysis to analyze joint angles
- carry out EMG measurements and evaluate the data regarding muscle activation and timing
- carry out task specific plantar pressure measurements using insoles and to evaluate parameters relevant for this task.
- explain biomechanical and technical fundamentals/principals of course specific motion analysis systems (force plates, EMG, 2D and 3D video analysis, plantar pressure measurement insoles, inertial measuring units and eye-tracking)
- evaluate previously collected data and document the results according to scientific standards

	- explain the methodology of data collection and data evaluation in accordance to measurement system specific requirements (force plates, EMG, 2D video, plantar pressure measurement).
Course contents	- Conducting biomechanical experiments in a laboratory environment using various motion analysis systems. - Evaluating previously recorded data. - Documenting the results in accordance to scientific standards.
Prerequisites	Fundamental knowledge of the functional anatomy of the human torso as well as the upper and lower extremity.
Assessment Methods	- Written Results Documents (group assessment) - Practical Exam Part 1 (practical exam on data collection, group assessment) - Practical Exam Part 2 (individual oral exam on fundamentals of measurements systems, data collection and evaluation)
Recommended Reading and Material	
Attendance	As this course is a laboratory exercise, the compulsory attendance is 100%.
Comments	

Mechanical Engineering (BMB)

Manufacturing Engineering

Degree programme	BMB
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course students acquire basic knowledge in the fields of production engineering according to DIN 8580.
Teaching methods	Integrated course
Learning outcome	After passing this course successfully students are able to ... - specify essential industrial requirements for manufacturing processes using appropriate technical parameters,

- explain selected manufacturing processes from the main groups mentioned in DIN 8580 with regard to basic physical or chemical principles,
- describe a manufacturing process using one or more of these methods by means of the underlying process flow logic (material flow).

Course contents	- Requirements for industrial manufacturing processes (incl. measured variables) - Overview of main groups of manufacturing processes (DIN8580)
Prerequisites	Basic knowledge according to admission requirements for the bachelor's program
Assessment Methods	- Participation, homework and Moodle-exams
Recommended Reading and Material	- Förster, R.; Förster, A.: Einführung in die Fertigungstechnik, Springer Vieweg, 2018
Attendance	75%
Comments	The course is held exclusively in English.

Materials Science

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

Course description In this course you will get an overview of the most important materials of our everyday life - have an insight into atomic levels, learn what these materials are capable of and what we use them for. Learn how to select the right material for a product design and carry out proper material tests in the laboratory course!

Teaching methods Integrated course

Learning outcome After passing this course successfully students are able to ...
 - to explain the basic properties of metallic materials (steel, cast iron, aluminium, copper, titanium, magnesium and their alloys) from a scientific and technical point of view, using practical industrial examples

- explain the basics of microscopy and electron microscopy
- to be able to make a simple material selection of metals
- To be able to name metallic materials.
- be able to enumerate metallic materials compared to plastics and ceramics as well as composite materials with advantages and disadvantages
- explain the basics of mechanical methods for testing materials as well as selected concrete test methods using appropriate technical terms and quantities (tensile test, hardness test, Charpy, Wöhler)

Course contents

- Terms (e.g. thermal expansion, modulus of elasticity, ...) and material properties
- Atomic decomposition & periodic table, chemical bonds
- Structure of metals (krz, kfz, hdp)
- Iron-carbon diagram
- Steel and cast iron
- Aluminium materials
- Copper Materials
- Titanium materials
- Magnesium materials
- Alloys, phase diagrams
- Electrochemistry especially corrosion of metallic materials
- Mechanical test methods (tensile test, notched bar impact bending test, hardness test, Wöhler test), PT, MT, VT; UT.
- effects of mechanical stress (e.g. deformation, work hardening)
- Interaction of material and production technology, example forging
- Basic principles of material selection (presentation of software tools)
- Differences of the material classes (metals, plastics, ceramics)
- Electron microscopic examination of various materials

Prerequisites

Basic knowledge according to admission requirements for the bachelor's program
Prior knowledge of manufacturing technology from the course "Manufacturing Engineering"

Assessment Methods

- Participation and presentation, Moodle tests and final examination

Recommended Reading and Material

- - Ashby, M.F.; Jones, D.R.H.: Engineering Materials 1: An Introduction to Properties, Applications and Design, Elsevier, 2011

Attendance

75%

Comments

More detailed information can be found in the Moodle course.

Technical English

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

Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	<ul style="list-style-type: none"> - Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	<ul style="list-style-type: none"> - Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag.

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

Attendance Obligatory

Comments

Applied Computer Science

Degree programme BMB

Semester 3

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description Software has become part of all areas of engineering. Therefore, basic education in applied computer science and the development of software are standard components of the graduates' toolkit. During teaching, special emphasis is given to the abstraction of requirements and subsequently the realisation of corresponding software systems. In classroom sessions and self-study, you will gain insights into programming with Python and the creation of algorithms using flowcharts and Python as the programming language. Python is a high-level programming language with a wide range of applications in mechanical engineering, industrial engineering and the field of renewable energies. The implementation of practical tasks based on selected use cases will enable you to acquire basic skills for creating programmes. Five pen and paper tests keep you on track and will consequently challenge you to acquire implementation knowledge. Practical work with collections, files, classes and graphical user interfaces will expand your ability to solve problems using your programming skills. As the course progresses, you will develop code with the support of AI, enabling you to further enhance your implementation skills.

Teaching methods Combination of classes and self-study phases

Learning outcome After passing this course successfully students are able to ...
 - analyse simple problems/tasks, - develop algorithmic solutions (using flowcharts) and implement them using structured programming techniques.

- understand and apply the basic functions of programming languages: reading, processing and outputting structured data, basic operations in data structures, control structures (conditional queries, loops, functions).
- use Python Classes.
- perform software tests.
- create and use virtual environments.
- create graphical user interfaces.
- visualize data graphically.
- utilize MQTT and process API requests.
- write code with AI support.
- implement a software project.

Course contents

- Introduction to programming with Python
- Data processing: reading, processing, and outputting data
- Control structures, loops, and functions
- Collections & File Handling
- Python Classes
- Software Testing & Unittests
- Virtual Environments & Application Building
- Creating graphical user interfaces
- Data Visualisation
- MQTT & API-Requests
- AI-supported coding (Vibe Coding)
- Software-Project

Prerequisites

none

Assessment Methods

- Pen & Paper Tests
- Project
- 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

Business Informatics (BWI)

Business Process Engineering

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

Course description Students learn about the definition of business processes and the use of business processes in an organization. Based on different aspects, students also learn to assess, model, improve and document business processes.

Teaching methods

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

- discuss relevant aspects of organization-wide business process management ,
- assess and describe business processes,
- model business processes (e.g. with BPMN),
- develop a business process handbook,
- apply techniques and methods of process improvement,
- apply methods of business process assessment and BPM maturity models.

Course contents

- Introduction to Business Process Management & Strategic Business Process Management
- Process identification
- Process discovery
- Qualitative process analysis and costs
- Quantitative process analysis and simulation
- Process redesign
- Process awareness and monitoring
- BPM as an Enterprise Capability, BPM Maturity Models

Prerequisites Process modeling with Academic Signavio

Assessment Methods

- Creation of process Manual and Business Management Manual
- Online Tests (closed book)
- Presentations

Recommended Reading and Material	- Dumas, M.; La Rosa, M.; Mendling, J.; Reijers, H.A., 2018. Fundamentals of Business Process Management. Springer. - Slides - Scripts
Attendance	mandatory
Comments	

Digital Business Planning

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

Course description In this sub-module of the specialization "Digital Entrepreneurship", students acquire basic skills for the development of digital business models. They will learn the steps required to found a start-up based on an innovative business idea and how to create a business plan for it.

Teaching methods Self-study, Lecture, Discussion of case studies, Group work

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

- enumerate the components of a business model,
- differentiate between different types of business models,
- to further develop business models through the use of digital technologies (e.g. artificial intelligence, block chain etc.)
- develop an innovative business idea (e.g. using design thinking, lean start-up etc.) and develop it into a digital or data-based business model,
- name the components of a business plan,
- convincingly present a business idea and the key points of a business plan in an elevator pitch,
- outline the steps to start a business,
- identify different sources of financing a business start-up,
- weigh up the advantages and disadvantages of different legal forms against each other,
- to comply with the obligations resulting from the establishment of a

company (e.g. trade law, social security, taxes etc.)
- to name the success factors for cooperation between corporations and start-ups.

Course contents

- Digital Entrepreneurship
- Business Model
- Types of business models
- Digital business models
- Innovator's dilemma
- Mission and vision
- Business Model Canvas
- Blue Ocean Strategy
- Market research
- Lean Start-Up
- Start-up scene
- Corporate Venturing
- Business Planning
- Business Scaling
- Company foundation
- Choice of legal form
- Start-up financing
- Elevator Pitch

Prerequisites

General Management; Accounting

Assessment Methods

- Continuous performance assessment (discussion contributions, group work, midterm tests etc.)

Recommended Reading and Material

- Byers/Dorf/Nelson: Technology Ventures: From Idea to Enterprise
- Wirtschaftskammer Österreich: Leitfaden zur Unternehmensgründung

Attendance

Mandatory

Comments

IT Security Basics

Degree programme

BWI

Semester

5

Course methods

ILV

Language

English

ECTS Credits

3.00

Incoming places	Limited
Course description	The course offers an overview of the fundamentals of IT security and deals with cryptographic methods, authenticity, key management, access control and secure communication.
Teaching methods	
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Basics of Information Security - Threat to IT security and sources of danger (internal and external threats) - Basics of cryptography - HMAC - Public key infrastructures (PKI) - Signatures - Certificates - access control - Identification/Authentication/Authorization - Password security/entropy - DMZ, Firewall & IDS/IPS - IPSec - Transport Layer Security - Secure communication mechanisms
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Scientific Writing and Research Methods

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course prepares students for writing scientific papers, especially the bachelor thesis.
Teaching methods	The integrated course consists of three parts: The self-study phase teaches basic research methods. This is consolidated further in class through practical exercises. In addition, the writing phase offers the opportunity to implement the acquired knowledge in the form of a seminar paper.
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - explain the standards that characterize scientific work. - formulate research questions and hypotheses. - select and apply methods for the chosen questions - structure a scientific paper in a formally correct manner. - write a proposal (exposé, disposition) for a seminar or bachelor thesis. - conduct (literature) research, to evaluate sources and to cite according to scientific standards. - explain formal and linguistic demands on a scientific text and to implement them in the writing phase.
Course contents	<ul style="list-style-type: none"> - Criteria of correct scientific conduct - Methods and theories of gaining knowledge - Structuring and composition of scientific work - Guidelines for ensuring good scientific practice - Research questions - their formulation, operationalization - Strategies of source acquisition - Documentation of sources - Proposal (exposé, disposition) - Scientific writing style and basic features of argumentation - Formal design of academic papers
Prerequisites	none

Assessment Methods	- Ongoing performance review through mini-tests and written assignments
Recommended Reading and Material	- Leedy, P.D. & Ormrod, J.E., 2015. Practical research. Planning and design 11 Aufl., Harlow, GB: Pearson Education. - Skern, T., 2019. Writing scientific English. A workbook, Stuttgart: UTB. - Theuerkauf, J., 2012. Schreiben im Ingenieurstudium. Effektiv und effizient zur Bachelor-, Master- und Doktorarbeit, Paderborn: Schöningh.
Attendance	100%
Comments	

IT-Based Controlling

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

Course description In this course, typical internal accounting tasks (cost accounting, financing, controlling) are carried out with the help of software.

Teaching methods Workshops, Exercises

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

- analyse annual financial statement using key business figures
- calculate cash flows
- perform cost and performance accounting tasks (cost type, cost center, cost unit, and cost unit accounting)
- prepare investment decisions
- compare financing alternatives
- prepare variance analyses
- present the results of business decision calculations

Course contents

- Creation of business cases for investments using dynamic investment calculation methods such as net present value, internal rate of return, WACC, dynamic payback period, using appropriate Excel functions
- Product cost determination through internal cost allocation using a

simultaneous approach, employing appropriate Excel matrix functions and surcharge calculation

- Efficient processing of large amounts of data with import and pivot functions
- Identification of financing gaps, comparison of financing alternatives including borrowing and evaluation using the annuity method, effective annual interest rate, etc. with the tools available in Excel
- Analysis of planned/actual deviations in sales and costs, including differentiation between quantity and price deviations
- Determination of optimal production and sales programs in situations of multiple bottlenecks using Solver
- Review and improvement of data quality in the context of multi-year planning using a series of descriptive statistical indicators (median, kurtosis, variance, percentiles, etc.) in Excel, as well as the creation of intuitively comprehensible graphical evaluations

Prerequisites ManagementAccountingInvestment & Financing

Assessment Methods

- 1 interim test (50 points)
- 1 final exam (50 points)

Recommended Reading and Material

Attendance Mandatory

Comments

Software Security

Degree programme BWI

Semester 5

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

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

security is built in and therefore software is developed with security in mind

Teaching methods

Learning outcome

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

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

Course contents

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

Prerequisites

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

Assessment Methods

Recommended Reading and Material

- SAML Specifications 2.1
- OAuth 2.0 Authorization Framework - RFC6749
- OWASP 10 2021+/-
- NIST Secure Software Development Framework
- OWASP Secure Coding Guideline

Attendance

Comments

Tool-Based Data Ops

Degree programme

BWI

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

Course description This course focuses on no-code/low-code data automation using KNIME, empowering you to handle complex data workflows without requiring programming knowledge.

Teaching methods - Short presentations- Group presentations- Interactive tutorials- Practical group work (on-site and remote)

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

- Understand the Foundations of Data Management and Data Quality
- Master the Fundamentals of KNIME for Data Automation
- Integrate and Automate Data from Multiple Sources in KNIME
- Leverage Advanced Data Engineering Techniques in KNIME
- Apply Machine Learning Models in KNIME
- Design and Automate End-to-End Reporting and BI Workflows
- Productionize Data Applications for Pipelines

Course contents

- Data Ops and KNIME Basics
- Data quality and data integration
- Data Governance, Data Engineering and KNIME Flow Control
- ML and BI Automation in KNIME
- Productionizing Data Apps and Pipelines

Prerequisites

Assessment Methods - The final grade will be based on group work as well as individual components (assignments, mini tests, practical tutorials)

Recommended Reading and Material

Attendance

Comments

Software Quality & DevOps

Degree programme	BWI
Semester	5

Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description The fourth part of the specialization "UX & Software Quality Assurance" addresses software quality management and deployment.

Teaching methods

Learning outcome

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

- discuss basics of quality criteria
- apply quality measures in practice
- explain quality standards (e.g. IEEE) and apply aspects of them
- Visualize core software quality criteria for decision making
- assess the importance of software
- carry out a risk assessment for software projects
- explain the principles and advantages of devops and the relationship to quality management
- Discuss culturall aspects of devops (communication, collaboration, integration, automatisaton)
- practice roles, teams and project structures related to DevOps
- Plan steps for the implementation of DevOps in a use case

Course contents

- quality management
- quality standards
- risk assessment
- DevOps

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Backend Web Engineering

Degree programme	BWI
Semester	5
Course methods	ILV

Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description This course enables students to develop (mobile) web applications using current frontend web frameworks. Relevant web frameworks (such as Spring Boot, Symfony and FLASK) will first be presented, and an own project using Spring Boot implemented based on the framework-specific design and architectural principles. A REST-API will be implemented and authorized through JWT. Main focus will be given to practical work.

Teaching methods

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

- plan and implement dynamic web applications using server-side programming (using Spring Boot)
- use general concepts of server-side implementation (sessions, data transmission, authentication) for own projects
- implement and link data bases to web applications
- implement data exchange between client and server using Ajax and JSON
- implement maintainable software using selected frontend frameworks

Course contents

- Base technologies of webserver infrastructure
- Fundamentals of server-side programming (sessions, cookies, data exchange)
- Java Spring Boot Programming
- Interfacing Data Bases
- Provision of Restful Web Services

Prerequisites Structured and OO Programming; Data Management; Web Engineering

Assessment Methods - Project Work

Recommended Reading and Material

Attendance mandatory

Comments

Frontend Web Engineering

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course enables students to develop (mobile) web applications using current frontend web frameworks. Relevant web frameworks (such as React, Angular and Vue.js) will first be presented, and an own project using Vue.js implemented based on the framework-specific design and architectural principles. The integration with a REST-API will be implemented using Ajax; JSON will be used for data exchange. Main focus will be given to practical work.
Teaching methods	Short presentations; project work; self-study with practical examples; coaching.
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - give an overview of relevant frontend web frameworks and discuss pros and cons - implement maintainable software using selected frontend frameworks - implement data exchange between client and server using Ajax and JSON - explain the architecture and the design principles of specific frameworks and to apply them in SW development - deploy the implemented software
Course contents	<ul style="list-style-type: none"> - overview on relevant frontend frameworks - architecture and design principles of selected frameworks - components of a selected framework - programming using a selected framework
Prerequisites	Structured and OO Programming; Data Management; Web Engineering
Assessment Methods	- Project Work
Recommended Reading and Material	
Attendance	mandatory
Comments	

IT Infrastructure

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

Course description The course tackles important infrastructure (Hardware and Software) for digital Enterprises, ranging from computing centers to smart devices while focusing on selection, planning and rollout of this infrastructure.

Teaching methods

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

- assess basic concepts of virtualization and container technologies
- plan a redundant computing center and the required hardware
- automate the rollout of infrastructure using Infrastructure as Code (IaC) and document and monitor it using a configuration management data base (CMDB)
- define criteria for hardware tender procedures
- describe use cases for smart devices in companies

Course contents

- Data Center Basics
- Server, Storage and Networking hardware and protocols
- Scalability and Redundancy
- Virtualization and different hypervisors, Virtual Machines vs. Container technologies
- Infrastructure as Code (IaC) and configuration management, CMDBs and IT documentation, Monitoring
- Smart Devices and equipment (e.g., cameras, drones, sensors)
- Hardware procurement
- Planning, Design and Rollout of enterprise IT infrastructure

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Cloud Computing

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

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

Teaching methods

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

- evaluate pros and cons of various deployment models (on premise vs. diverse cloud alternatives) and choose the best one for a project
- evaluate Cloud Service Providers and applications according to suitable criteria, carry out a TCO calculation and select the best solution
- configure and monitor several instances in a public cloud environment
- develop own applications in a Platform as a Service (PaaS) context

Course contents

- Cloud Computing NIST definition, architecture and deployment models
- Cloud Computing NIST definition, architecture and deployment models
- Hybrid Cloud Solutions
- Cloud Computing platforms & applications, basics of Cloud Application Development
- Economic aspects of Cloud Computing, Outsourcing, TCO calculations
- Legal aspects, cloud standards
- Selection of CSPs, Vendor Lock-In

Prerequisites

Assessment Methods

**Recommended Reading
and Material**

Attendance

Comments

Machine Learning

Degree programme BWI

Semester 5

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description The fourth part of the specialization "Big Data & Data Science" focuses on Machine Learning.

Teaching methods

Learning outcome After passing this course successfully students are able to ...
 - fit machine learning models (supervised, unsupervised) to data
 - assess and compare the performance of predictive models
 - get into new data science topics

Course contents

- Supervised Learning: Trees, Neural Networks, k-NN, Naive Bayes
- Unsupervised Learning: PCA, Medoid-Based Clustering, Association Rules
- Benchmarking and Tuning of machine learning algorithms
- Special Topics (Text Mining, Network Analysis)

Prerequisites Course: "Data Engineering"; Course: "Applied Probability and Statistics"; Course: "Applied Statistics and Data Analysis"; Course: "Introduction to Statistical Learning"

Assessment Methods

**Recommended Reading
and Material**

Attendance

Comments

Data Science Engineering

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

Course description The third part of the specialization "Big Data & Data Science" introduces data engineering and data visualization

Teaching methods

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

- import raw data from various sources (data bases, internet) in various formats
- preprocess raw data for further processing
- critically assess diagrams
- visualize data for exploration
- create interactive graphics

Course contents

- create data science projects using R studio
- manipulate data with the R tidyverse framework
- Fundamentals of visualization
- create meaningful diagrams using ggplot2
- create interactive diagrams

Prerequisites Course: "Applied Probability and Statistics" Course: "Applied Statistics and Data Analysis"

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Business Simulation Game

Degree programme	BWI
Semester	5
Course methods	UE
Language	English

ECTS Credits	2.00
Incoming places	Limited
Course description	In this sub-module, students deepen, expand and cross-link the business management skills taught in previous semesters within the course of a business game.
Teaching methods	Flipped Classroom
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - formulate value-oriented corporate goals - differentiate between strategic and operative business decisions - optimally coordinate the various marketing policy instruments - evaluate the advantages of investments using suitable calculation methods - develop an optimal production and sales program - weigh up between in-house production and external procurement - conduct a break-even analysis - calculate balance sheet ratios for the interpretation of financial statements - identify rationalization potentials and take appropriate measures to realize them - deal with large amounts of information in a structured way
Course contents	<ul style="list-style-type: none"> - Strategic Management - Accounting - Balance Sheet Analysis - Procurement Management - Production Management - Marketing - Investment Planning - Cost Accounting
Prerequisites	Fundamentals of Business Administration
Assessment Methods	- Immanent performances (100%)
Recommended Reading and Material	- Wala, Grobelschegg: Kernelemente der Unternehmensführung, Linde-Verlag
Attendance	Mandatory
Comments	Details see Moodle course

Creativity & Complexity

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

Rapid Application Development

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

Course description The fourth part of the specialization "Business Applications" tackles the tool-based development of data base-intensive applications.

Teaching methods

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

- assess the advantage of No-Code/Low-Code applications vs. classic software development
- identify use cases for No-Code/Low-Code
- Choose a suitable NCLC development platform
- Using some platform (e.g., MS Power Apps), create simple business applications
- Apply security mechanisms
- Integrate the application with existing systems using interfaces

Course contents

- No-Code and Low-Code development platforms
- Functions of Application Builder
- Integration of DB applications into existing infrastructure
- security aspects

Prerequisites

Assessment Methods

**Recommended Reading
and Material**

Attendance

Comments

Business Process Engineering

Degree programme BWI

Semester 3

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description Students learn about the definition of business processes and the use of business processes in an organization. Based on different aspects, students also learn to assess, model, improve and document business processes.

Teaching methods

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

- discuss relevant aspects of organization-wide business process management ,
- assess and describe business processes,
- model business processes (e.g. with BPMN),
- develop a business process handbook,
- apply techniques and methods of process improvement,
- apply methods of business process assessment and BPM maturity models.

Course contents

- Introduction to Business Process Management & Strategic Business Process Management
- Process identification
- Process discovery
- Qualitative process analysis and costs
- Quantitative process analysis and simulation
- Process redesign
- Process awareness and monitoring
- BPM as an Enterprise Capability, BPM Maturity Models

Prerequisites Process modeling with Academic Signavio

Assessment Methods - Creation of Process Manual and Business Process Management Manual
 - Online Tests (closed book)
 - Presentations

Recommended Reading and Material - Dumas, M.; La Rosa, M.; Mendling, J.; Reijers, H.A., 2018. Fundamentals of Business Process Management. Springer.
 - Slides
 - Scripts

Attendance mandatory

Comments

Digital Innovation

Degree programme BWI

Semester 5

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description In this sub-module of the specialization "Digital Entrepreneurship", students acquire basic skills in the field of innovation and technology management as well as digital transformation.

Teaching methods Self-study, Lecture, Discussion of case studies, Group work

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

- differentiate between different types of innovation (e.g. product innovation, process innovation etc.)
- outline the tasks to be addressed in the course of innovation management,
- create the organizational and personnel prerequisites for an innovation-friendly corporate culture,
- Develop an innovation strategy to support the achievement of the company's strategic goals,
- develop a systematic innovation process from idea generation inside and outside the company to market launch,
- to carry out forecasts regarding the development of digital technologies (e.g. artificial intelligence, virtual reality, etc.) and to assess the relevance of these technologies for their own company,

- to initiate and maintain technology collaborations with other companies (e.g. start-ups) or universities,
- apply creativity techniques to generate ideas for new products or processes,
- carry out economic feasibility analyses to evaluate innovation projects,
- systematically plan, manage, complete and evaluate innovation projects
- minimize the resistance in the workforce that regularly accompanies organizational innovations by means of change management.

Course contents

- Concept of innovation
- Types of innovation
- Innovation management
- Innovation culture
- Innovation strategy
- Innovation process
- Idea management
- Creativity techniques
- prototyping
- Open Innovation
- Economic efficiency calculation
- Management of innovation projects
- change management
- Digital transformation
- Technology foresight
- Business model innovations
- Innovation protection
- Innovation financing
- Innovation diffusion
- Innovation marketing

Prerequisites

General Management

Assessment Methods

- Continuous performance assessment (discussion contributions, group work, midterm tests, etc.)

Recommended Reading and Material

- Wala: Manual Innovations- und Technologiemanagement
- Wirtz: Crashkurs Innovationsmanagement

Attendance

mandatory

Comments

IT Security Basics

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course offers an overview of the fundamentals of IT security and deals with cryptographic methods, authenticity, key management, access control and secure communication.
Teaching methods	
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Basics of Information Security - Threat to IT security and sources of danger (internal and external threats) - Basics of cryptography - HMAC - Public key infrastructures (PKI) - Signatures - Certificates - access control - Identification/Authentication/Authorization - Password security/entropy - DMZ, Firewall & IDS/IPS - IPSec - Transport Layer Security - Secure communication mechanisms

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

IT-Based Controlling

Degree programme BWI

Semester 5

Course methods ILV

Language English

ECTS Credits 3.00

Incoming places Limited

Course description In this course, typical internal accounting tasks (cost accounting, financing, controlling) are carried out with the help of software.

Teaching methods Workshops, Exercises

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

- analyse annual financial statement using key business figures
- calculate cash flows
- perform cost and performance accounting tasks (cost type, cost center, cost unit, and cost unit accounting)
- prepare investment decisions
- compare financing alternatives
- prepare variance analyses
- present the results of business decision calculations

Course contents

- Creation of business cases for investments using dynamic investment calculation methods such as net present value, internal rate of return, WACC, dynamic payback period, using appropriate Excel functions
- Product cost determination through internal cost allocation using a simultaneous approach, employing appropriate Excel matrix functions and surcharge calculation
- Efficient processing of large amounts of data with import and pivot

functions

- Identification of financing gaps, comparison of financing alternatives including borrowing and evaluation using the annuity method, effective annual interest rate, etc. with the tools available in Excel
- Analysis of planned/actual deviations in sales and costs, including differentiation between quantity and price deviations
- Determination of optimal production and sales programs in situations of multiple bottlenecks using Solver
- Review and improvement of data quality in the context of multi-year planning using a series of descriptive statistical indicators (median, kurtosis, variance, percentiles, etc.) in Excel, as well as the creation of intuitively comprehensible graphical evaluations

Prerequisites

ManagementAccountingInvestment & Financing

Assessment Methods

- 1 interim test (50 points)
- 1 final exam (50 points)

Recommended Reading and Material

Attendance

Mandatory

Comments

Software Security

Degree programme

BWI

Semester

5

Course methods

ILV

Language

English

ECTS Credits

2.00

Incoming places

Limited

Course description

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

Teaching methods

Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Application Security - Secure by design principles - Secure authentication in SW - Web Application Security - Identity & Access Management - Risikobewertung in SW / Threat Modeling - DB Security
Prerequisites	<p>Knowledge of common web languages (HTML, JS, CSS, PHP, AJAX) Knowledge of object-oriented languages (Java C# / .net) Knowledge of handling databases (mySQL or Oracle) Basic knowledge of using Linux Knowledge of network protocols: Ethernet, IP/ARP, TCP/UDP, DNS, Application Layer protocols, Transport Layer Security or http/s, s/ftp, ssh,...</p>
Assessment Methods	
Recommended Reading and Material	<ul style="list-style-type: none"> - SAML Specifications 2.1 - OAuth 2.0 Authorization Framework - RFC6749 - OWASP 10 2021+/- - NIST Secure Software Development Framework - OWASP Secure Coding Guideline
Attendance	
Comments	

Rapid Application Development

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English

ECTS Credits	5.00
Incoming places	Limited
Course description	The fourth part of the specialization "Business Applications" tackles the tool-based development of data base-intensive applications.
Teaching methods	
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - assess the advantage of No-Code/Low-Code applications vs. classic software development - identify use cases for No-Code/Low-Code - Choose a suitable NCLC development platform - Using some platform (e.g., MS Power Apps), create simple business applications - Apply security mechanisms - Integrate the application with existing systems using interfaces
Course contents	<ul style="list-style-type: none"> - No-Code and Low-Code development platforms - Functions of Application Builder - Integration of DB applications into existing infrastructure - security aspects
Prerequisites	
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Backend Web Engineering

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	This course enables students to develop (mobile) web applications

using current frontend web frameworks. Relevant web frameworks (such as Spring Boot, Symfony and FLASK) will first be presented, and an own project using Spring Boot implemented based on the framework-specific design and architectural principles. A REST-API will be implemented and authorized through JWT. Main focus will be given to practical work.

Teaching methods

Learning outcome

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

- plan and implement dynamic web applications using server-side programming (using Spring Boot)
- use general concepts of server-side implementation (sessions, data transmission, authentication) for own projects
- implement and link data bases to web applications
- implement data exchange between client and server using Ajax and JSON
- implement maintainable software using selected frontend frameworks

Course contents

- Base technologies of webserver infrastructure
- Fundamentals of server-side programming (sessions, cookies, data exchange)
- Java Spring Boot Programming
- Interfacing Data Bases
- Provision of Restful Web Services

Prerequisites

Structured and OO Programming; Data Management; Web Engineering

Assessment Methods

- Project Work

Recommended Reading and Material

Attendance

mandatory

Comments

Frontend Web Engineering

Degree programme

BWI

Semester

5

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places	Limited
Course description	This course enables students to develop (mobile) web applications using current frontend web frameworks. Relevant web frameworks (such as React, Angular and Vue.js) will first be presented, and an own project using Vue.js implemented based on the framework-specific design and architectural principles. The integration with a REST-API will be implemented using Ajax; JSON will be used for data exchange. Main focus will be given to practical work.
Teaching methods	Short presentations; project work; self-study with practical examples; coaching.
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - give an overview of relevant frontend web frameworks and discuss pros and cons - implement maintainable software using selected frontend frameworks - implement data exchange between client and server using Ajax and JSON - explain the architecture and the design principles of specific frameworks and to apply them in SW development - deploy the implemented software
Course contents	<ul style="list-style-type: none"> - overview on relevant frontend frameworks - architecture and design principles of selected frameworks - components of a selected framework - programming using a selected framework
Prerequisites	Structured and OO Programming; Data Management; Web Engineering
Assessment Methods	- Project Work
Recommended Reading and Material	
Attendance	mandatory
Comments	

Agile Software Testing

Degree programme	BWI
Semester	5
Course methods	ILV

Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description The third part of the specialization "UX & Software Quality Assurance" tackles Software Testing in an agile setting.

Teaching methods

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

- describe and use proper software testing terminology
- describe the fundamental testing process and actively apply from a users' perspective
- describe and apply IT standards of software testing (e.g., IEEE 829)
- apply fundamental testing methods
- plan and carry out simple test automatization using unit tests and UI-driven development
- explain principles of agile software development
- explain the challenges of testing and quality assurance in agile projects
- carry out and support suitable testing activities in agile teams

Course contents

- testing principles
- testing planning
- testing
- testing documentation
- agile methods of testing

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Cloud Computing

Degree programme	BWI
Semester	5
Course methods	ILV
Language	English

ECTS Credits 5.00

Incoming places Limited

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

Teaching methods

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

- evaluate pros and cons of various deployment models (on premise vs. diverse cloud alternatives) and choose the best one for a project
- evaluate Cloud Service Providers and applications according to suitable criteria, carry out a TCO calculation and select the best solution
- configure and monitor several instances in a public cloud environment
- develop own applications in a Platform as a Service (PaaS) context

Course contents

- Cloud Computing NIST definition, architecture and deployment models
- Cloud Computing NIST definition, architecture and deployment models
- Hybrid Cloud Solutions
- Cloud Computing platforms & applications, basics of Cloud Application Development
- Economic aspects of Cloud Computing, Outsourcing, TCO calculations
- Legal aspects, cloud standards
- Selection of CSPs, Vendor Lock-In

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

IT Infrastructure

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

Course description The course tackles important infrastructure (Hardware and Software) for digital Enterprises, ranging from computing centers to smart devices while focusing on selection, planning and rollout of this infrastructure.

Teaching methods

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

- assess basic concepts of virtualization and container technologies
- plan a redundant computing center and the required hardware
- automate the rollout of infrastructure using Infrastructure as Code (IaC) and document and monitor it using a configuration management data base (CMDB)
- define criteria for hardware tender procedures
- describe use cases for smart devices in companies

Course contents

- Data Center Basics
- Server, Storage and Networking hardware and protocols
- Scalability and Redundancy
- Virtualization and different hypervisors, Virtual Machines vs. Container technologies
- Infrastructure as Code (IaC) and configuration management, CMDBs and IT documentation, Monitoring
- Smart Devices and equipment (e.g., cameras, drones, sensors)
- Hardware procurement
- Planning, Design and Rollout of enterprise IT infrastructure

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Machine Learning

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

Course description The fourth part of the specialization "Big Data & Data Science" focuses on Machine Learning.

Teaching methods

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

- fit machine learning models (supervised, unsupervised) to data
- assess and compare the performance of predictive models
- get into new data science topics

Course contents

- Supervised Learning: Trees, Neural Networks, k-NN, Naive Bayes
- Unsupervised Learning: PCA, Medoid-Based Clustering, Association Rules
- Benchmarking and Tuning of machine learning algorithms
- Special Topics (Text Mining, Network Analysis)

Prerequisites Course: "Data Engineering"; Course: "Applied Probability and Statistics"; Course: "Applied Statistics and Data Analysis"; Course: "Introduction to Statistical Learning"

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Data Science Engineering

Degree programme	BWI
Semester	5
Course methods	ILV

Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	The third part of the specialization "Big Data & Data Science" introduces data engineering and data visualization
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - import raw data from various sources (data bases, internet) in various formats - preprocess raw data for further processing - critically assess diagrams - visualize data for exploration - create interactive graphics
Course contents	<ul style="list-style-type: none"> - create data science projects using R studio - manipulate data with the R tidyverse framework - Fundamentals of visualization - create meaningful diagrams using ggplot2 - create interactive diagrams
Prerequisites	Course: "Applied Probability and Statistics" Course: "Applied Statistics and Data Analysis"
Assessment Methods	
Recommended Reading and Material	
Attendance	
Comments	

Creativity & Complexity

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

Course description	In this course, students deal with systematic problem solving, the systemic approach and common thinking traps. They learn methods for analysing problems and setting objectives (e.g. the paper computer etc.), for developing and selecting solution ideas (e.g. scamper, morphological box) and for decision-making and planning (e.g. decision matrix, Fermi method, three-time method) and apply these to professional examples.
Teaching methods	Impulse lecture, self-study (short videos, literature, etc.), input & action (presentation, case work, discussion, feedback)
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - explain the six steps of systematic problem solving and apply them to practical professional examples; - explain the difference between the systemic and non-systemic approach; - create a paper computer to analyse a problem and define objectives, for example, and recognise and deal with key pitfalls in data analysis; - explain and apply selected creativity techniques (e.g. scamper) to develop and select solution ideas; - use e.g. a decision matrix for decision-making and planning in the systematic problem-solving process; - select practical examples of problems and appropriate methods and plan, guide and control solution-orientated group work.
Course contents	<ul style="list-style-type: none"> - Basics of moderation - Systemic approach - Six steps of systematic problem solving - Methods for analysing and setting objectives - Methods for developing and preselecting solutions - Methods for decision-making and planning - Thinking traps
Prerequisites	none
Assessment Methods	- Course-immanent
Recommended Reading and Material	<ul style="list-style-type: none"> - Dobelli, Rolf: Die Kunst des klaren Denkens, 3. Edition 2020 - Dörner, Dietrich: Die Logik des Misslingens: Strategisches Denken in komplexen Situationen, 14. Aufl. 2003 - Kahneman, Daniel: NOISE - Was unsere Entscheidungen verzerrt, und wie wir sie verbessern können, 2021 - König, Eckard und Volmer. Gerda: Handbuch Systemische Organisationsberatung, 2. Auflage 2008 - Lehner, Martin: Erklären und Verstehen, 2018 (e-Book)

- Rosling, Hans: Factfulness, 9. Auflage 2018
- Rustler, Florian: Denkwerkzeuge der Kreativität und Innovation – Das kleine Handbuch der Innovationsmethoden, 9. Aufl. 2019
- Schilling, Gert: Moderation von Gruppen, 2005
- Vester, Frederic: Die Kunst vernetzt zu denken, 2002

Attendance Compulsory

Comments none

Business Simulation Game

Degree programme BWI

Semester 5

Course methods UE

Language English

ECTS Credits 2.00

Incoming places Limited

Course description In this sub-module, students deepen, expand and cross-link the business management skills taught in previous semesters within the course of a business game.

Teaching methods Flipped Classroom

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

- formulate value-oriented corporate goals
- differentiate between strategic and operative business decisions
- optimally coordinate the various marketing policy instruments
- evaluate the advantages of investments using suitable calculation methods
- develop an optimal production and sales program
- weigh up between in-house production and external procurement
- conduct a break-even analysis
- calculate balance sheet ratios for the interpretation of financial statements
- identify rationalization potentials and take appropriate measures to realize them
- deal with large amounts of information in a structured way

Course contents

- Strategic Management
- Accounting
- Balance Sheet Analysis

- Procurement Management
- Production Management
- Marketing
- Investment Planning
- Cost Accounting

Prerequisites Fundamentals of Business Administration

Assessment Methods - Immanent performances (100%)

Recommended Reading and Material - Wala, Grobelschegg: Kernelemente der Unternehmensführung, Linde-Verlag

Attendance 75%

Comments Details see Moodle course

Tool-Based Data Ops

Degree programme BWI

Semester 5

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description This course focuses on no-code/low-code data automation using KNIME, empowering you to handle complex data workflows without requiring programming knowledge.

Teaching methods - Short presentations- Group presentations- Interactive tutorials- Practical group work (on-site and remote)

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

- Understand the Foundations of Data Management and Data Quality
- Master the Fundamentals of KNIME for Data Automation
- Integrate and Automate Data from Multiple Sources in KNIME
- Leverage Advanced Data Engineering Techniques in KNIME
- Apply Machine Learning Models in KNIME
- Design and Automate End-to-End Reporting and BI Workflows
- Productionize Data Applications for Pipelines

Course contents

- Data Ops and KNIME Basics
- Data quality and data integration
- Data Governance, Data Engineering and KNIME Flow Control

- ML and BI Automation in KNIME
- Productionizing Data Apps and Pipelines

Prerequisites

Assessment Methods - The final grade will be based on group work as well as individual components (assignments, mini tests, practical tutorials)

Recommended Reading and Material

Attendance

Comments

Mechatronics/Robotics (BMR)

Technical English

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

Course description In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion

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

- record and employ technical vocabulary
- create and understand technical process instructions
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical

article and a process description)

Course contents	<ul style="list-style-type: none"> - Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	<ul style="list-style-type: none"> - Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	<ul style="list-style-type: none"> - Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Mobile and service robotics

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

Course description	<p>This course discusses the foundations of mobile and service robots. The main content of this course is classic mobile robot localization, path planning and path control. The participants learn the main concepts to control a mobile robot relying on traditional methods. During this course several exercises will be implemented by each participant relying on the robot operating system (ROS). Furthermore, they are going to implement and solve a mobile robot problem.</p>
Teaching methods	Integrative lecture, exercises
Learning outcome	After passing this course successfully students are able to ...

	<ul style="list-style-type: none"> - Understand the mechatronic modules of a mobile robot - Calculate and implement the kinematic model of mobile robots - Understand problems and solution of a mobile robot - Implement intelligent modules for mobile robot navigation
Course contents	<ul style="list-style-type: none"> - Modules of a mobile robot - Kinematics of mobile robots - Path planning with and without maps - Foundations of probabilistic robotics - ROS
Prerequisites	Math, industrial robots, C++
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	<ul style="list-style-type: none"> - Siegwart, R. und Nourbakhsh, I.R.; (2004) Introduction to Autonomous Mobile Robots (Intelligent Robots and Autonomous Agents), MIT Press - Russell, S., Norvig, P.; (2012) Artificial Intelligence: A modern approach, Pearson
Attendance	75%
Comments	

Electronic Engineering (BEL)

Technical English

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

Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering topics. Moreover, students will advance their technical verbal and written skills by creating technical object and technical process descriptions specifically for technical professional audiences and engineering purposes.
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Teaching methods

Learning outcome

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

- record and employ technical vocabulary in English,
- create and understand technical process instructions in English,
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description).

Course contents

- Visualizing technical descriptions in English
- Describing technical visualizations in English
- Technical object descriptions in English
- Technical process descriptions in English
- Technical English talk
- Exercises on selected technical topics

Prerequisites

B2 level English

Assessment Methods

- group tasks, language tasks, in-class writing

Recommended Reading and Material

- R. Murphy, English Grammar in Use, 5th Edition, 2019, Klett Verlag
- A. Oshima, A. Hogue, Writing Academic English, 4th Edition, 2006 Pearson Longman

Attendance

obligatory

Comments

Microcontroller Software Design

Degree programme

BEL

Semester

3

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

This course covers microcontrollers, in particular to program software in order to interface with various peripherals.

Teaching methods

Learning outcome

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

- design and analyze bare-metal software for microcontroller systems,
- use build systems for microcontrollers (cross-development, remote

debugging ...) efficiently,
 - configure and program typical peripheral units of microcontrollers (e.g. GPIO, Timer, Interrupt Controller, ADC/DAC, UART, SPI, I2C etc.),
 - control sensors and/or actuators with the help of microcontroller's peripheral units
 - as well as to develop applications, as they occur in typical electronic systems, in the context of hands-on projects.

Course contents

- Architecture of modern microcontrollers
- Cross-Development & Debugging
- Interrupts
- General Purpose Input/Output (GPIO)
- Timer, Real-Time Clock, Watchdog
- Analog-to-Digital and Digital-to-Analog Conversion (ADC/DAC)
- Serial interfaces like UART, SPI or I2C
- Implementation of tasks and projects as they occur in typical electronic systems

Prerequisites

Courses "Hardware-related Software Development" and "Fundamentals of Digital Systems"

Assessment Methods

- Exam, assessment of individual tasks and projects

Recommended Reading and Material

- M. Barr, Programming Embedded Systems in C and C++, 1999, O'Reilly Media, Inc.
- W.A. Smith, C Programming for Embedded Microcontrollers, 2008, Elektor International Media BV
- J. Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, 2014, Newnes, ISBN 978-0-12-408082-9
- M. Fischer, ARM Cortex M4 Cookbook, 2016, Packt Publishing, ISBN 1782176500

Attendance

mandatory

Comments

Technical English

Degree programme	BEL
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00

Incoming places Limited

Course description In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering topics. Moreover, students will advance their technical verbal and written skills by creating technical object and technical process descriptions specifically for technical professional audiences and engineering purposes.

Teaching methods

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

- record and employ technical vocabulary in English,
- create and understand technical process instructions in English,
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description).

Course contents

- Visualizing technical descriptions in English
- Describing technical visualizations in English
- Technical object descriptions in English
- Technical process descriptions in English
- Technical English talk
- Exercises on selected technical topics

Prerequisites B2 level English

Assessment Methods - group tasks, language tasks, in-class writing

Recommended Reading and Material

- R. Murphy, English Grammar in Use, 5th Edition, 2019, Klett Verlag
- A. Oshima, A. Hogue, Writing Academic English, 4th Edition, 2006 Pearson Longman

Attendance obligatory

Comments

Microcontroller Software Design

Degree programme BEL

Semester 3

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places	Limited
Course description	This course covers microcontrollers, in particular to program software in order to interface with various peripherals.
Teaching methods	
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - design and analyze bare-metal software for microcontroller systems, - use build systems for microcontrollers (cross-development, remote debugging ...) efficiently, - configure and program typical peripheral units of microcontrollers (e.g. GPIO, Timer, Interrupt Controller, ADC/DAC, UART, SPI, I2C etc.), - control sensors and/or actuators with the help of microcontroller's peripheral units - as well as to develop applications, as they occur in typical electronic systems, in the context of hands-on projects.
Course contents	<ul style="list-style-type: none"> - Architecture of modern microcontrollers - Cross-Development & Debugging - Interrupts - General Purpose Input/Output (GPIO) - Timer, Real-Time Clock, Watchdog - Analog-to-Digital and Digital-to-Analog Conversion (ADC/DAC) - Serial interfaces like UART, SPI or I2C - Implementation of tasks and projects as they occur in typical electronic systems
Prerequisites	Courses "Hardware-related Software Development" and "Fundamentals of Digital Systems"
Assessment Methods	- Exam, assessment of individual tasks and projects
Recommended Reading and Material	<ul style="list-style-type: none"> - M. Barr, Programming Embedded Systems in C and C++, 1999, O'Reilly Media, Inc. - W.A. Smith, C Programming for Embedded Microcontrollers, 2008, Elektor International Media BV - J. Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, 2014, Newnes, ISBN 978-0-12-408082-9 - M. Fischer, ARM Cortex M4 Cookbook, 2016, Packt Publishing, ISBN 1782176500
Attendance	mandatory
Comments	

Information and Communication Systems and Services (BIC)

Technical English

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

Course description In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion

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

- record and employ technical vocabulary
- create and understand technical process instructions
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)

Course contents

- Understanding the importance of English in international technical communication
- Technical product descriptions
- Technical process descriptions
- Analysing and describing the impacts of technologies
- Formal writing and paragraph construction

Prerequisites B2 level English

Assessment Methods - Vocabulary Test (15%)

- Self-Study and Class Preparation (25%)
- Written Test (60%)

Recommended Reading and Material

- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag.
- Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.

Attendance

Obligatory

Comments

Microcontroller Software Design

Degree programme

BIC

Semester

3

Course methods

LAB

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

This class illustrates the use of microcontrollers - in particular, the development of embedded software in order to interface with various peripherals. This involves communication with sensors and control of actuators as well as interfacing with a remote PC for data visualization and remote control.

Teaching methods

Impulse lecture, labs to program a microcontroller by way of a commercial of the shelf evaluation board

Learning outcome

- After passing this course successfully students are able to ...
- develop bare-metal embedded systems software.
 - to make efficient use of embedded build systems (cross-development, remote debugging etc.).
 - explain the functionality of typical peripheral units (interrupt controller, GPIO, Timer, ADC, UART etc.) and be able to configure and program them.
 - interact with the environment using the microcontroller along with sensors and actuators.
 - develop embedded software for degree program tailored tasks and projects using a specific commercial of the shelf development platform.

Course contents

- CPU Architectures of modern microcontrollers

- Cross-Development & Cross-Debugging
- Reading and working with Circuit Diagrams, Datasheets, Application Notes and a HAL API Documentation
- Interrupts
- General Purpose Input/Output (GPIO)
- Timer, Real-Time Clock, Watchdog
- Analog-to-Digital and Digital-to-Analog Conversion (ADC/DAC)
- Universal Asynchronous Receiver/Transmitter (UART)
- Serial Peripheral Interface (SPI)
- Interchip Communication (I2C)
- Implementation of degree program specific tasks and projects

Prerequisites Programming(solid programming skills using C), Digital Logic & Computer Architectures

Assessment Methods - Submission of assignments, test, and final project. The final project must be passed to successfully complete the course. Additionally, at least 50% of the total points for this course must be achieved.

Recommended Reading and Material

- H. Bernstein, "Mikrocontroller - Grundlagen der Hard- und Software der Mikrocontroller ATtiny2313, ATtiny26 und ATmega32", Springer Vieweg, 2020, ISBN 978-3-658-30066-1.
- M. Fischer, "ARM Cortex M4 Cookbook", Packt Publishing, 2016, ISBN-10: 1782176500.
- T. Martin, "The Insider's Guide To The STM32 ARM Based Microcontroller", Hitex Ltd., 2008, ISBN: 095499888.
- A. Kurniawan, "STM32 Nucleo-32 Development Workshop", PE Press, 2018.
- J. Yiu, "The Definitive Guide to ARM Cortex -M3 and Cortex-M4 Processors", Newnes, 2014, ISBN13: 978-0-12-408082-9.

Attendance mandatory

Comments none

Biomedical Engineering (BBE)

Technical English

Degree programme	BBE
Semester	1
Course methods	UE
Language	English
ECTS Credits	3.00

Incoming places	Limited
Course description	In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.
Teaching methods	small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - record and employ technical vocabulary - create and understand technical process instructions - identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)
Course contents	<ul style="list-style-type: none"> - Understanding the importance of English in international technical communication - Technical product descriptions - Technical process descriptions - Analysing and describing the impacts of technologies - Formal writing and paragraph construction
Prerequisites	B2 level English
Assessment Methods	<ul style="list-style-type: none"> - Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	<ul style="list-style-type: none"> - Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Bioinformatics

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

Medical Imaging and Analysis

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

Course description Medical imaging is crucial to the diagnosis, therapy planning and therapy monitoring of various pathologies. Essentially, a distinction can be made between anatomical (X-ray, CT, MRI, ultrasound) and functional (PET, SPECT, etc.) imaging modalities. While anatomical imaging modalities, as the name suggests, provide information about the anatomical features, functional imaging modalities provide information about the metabolic function of certain organ systems or tumors. Depending on the diagnostic question and indication of the imaging, different processing and analysis methods have to be applied in order to obtain a data set from the image that can be evaluated by medical personnel. This process is the subject of the course Medical Imaging & Analysis.

Teaching methods The teaching and learning materials provided include video recordings of lectures on individual topics, as well as publications from research institutions or other subject-related international organizations. For the exercises and assignments, students will need MATLAB and other freely available software tools.

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

- Develop simple prototypes for basal image processing in concrete medical problems in MATLAB.
- Understand the functionality of simple image processing operations in commercial software and apply them appropriately to the situation.
- transfer medical image data to other systems for further use in

medical technology issues.

Course contents

- Basics of Medical Imaging Physics & Imaging Modalities
- Image Representation, File Formats and Simple Operations
- Operations in Intensity Space
- Filtering & Image Transformations
- Spatial Transformations & Rendering

Prerequisites

Mathematik für Engineering Science 1 Mathematik für Engineering Science 2 Grundlagen der Programmierung Anwendungen der Programmierung in Life Science Engineering Grundlagen der Physik für Ingenieurwissenschaften

Assessment Methods

- Performance assessment will be based on programming assignments (50%) and a final exam (50%).

Recommended Reading and Material

- W. Birkfellner, with contributions by M. Figl, J. Hummel, Z. Yaniv and Ö. Güler: Applied Medical Image Processing – A Basic Course, 2nd Edition, CRC Press, ISBN: 978-1-4665-5557-0

Attendance

Attendance of minimum 75% is mandatory. If attendance is less than 75% the first exam attempt is considered negative.

Comments

Medical Data Engineering 2

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

Course description

Continuation of the course "Medical Data Engineering 2

Teaching methods

Learning outcome

- After passing this course successfully students are able to ...
- to independently develop software for the health care system using the services of the Health Information Network (GIN, Austrian eCard System, electronic insurance card).
 - to develop database applications for the health care system.
 - to document the work in projects.
 - in writing and analysing texts the - to apply basic rules of scientific

work, distinguishing a scientific approach from a non-scientific (everyday) one

Course contents

- Software development in health care projects
- IHE and basic standards
- C# Programming
- Austrian eCard infrastructure, - Health Information Network GIN, Applications

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Biomedical Ex Vivo Models

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

Course description

In this course, students learn selected ex vivo models, which are important tools for biomedical research. There is a growing need for ex vivo systems, lab-on-a-chip technologies, and disease models for biomedical problems to overcome the shortcomings and drawbacks of traditional in vitro systems and animal models. A key advantage is the ability to perform tests or measurements that would not be possible or ethical in living subjects. This includes, for example, the study of the brain, spinal cord and peripheral nerve tissue regeneration or the measurement of physical, thermal, electrical, mechanical, optical and other tissue properties.

Teaching methods

Self-study preparation, in class lectures, Moodle quizzes

Learning outcome

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

- Name common ex vivo organ models and explain their scope of application.

- Explain selected respiratory and optical models.
- Describe methods for creating cell-based systems and organoids.
- Explain applications of cell-based systems and organoids in disease models and testing of chemicals and discuss them using specific examples.

Course contents

- Definitions - in vitro, in vivo, ex vivo, and in silico
- 3D-Organoids
- Modelling of different organs based on microfluidic technologies
- Modelling of the lung as a whole organ
- Modelling of the eye

Prerequisites

ILV Biochemistry and Molecular Biology

Assessment Methods

- Moodle exams during the classes (30%)
- Moodle exam (final exam) during the last class (70%)

Recommended Reading and Material

Attendance

Attendance is compulsory

Comments

Biomedical Engineering Projects

Degree programme

BBE

Semester

5

Course methods

PRJ

Language

English

ECTS Credits

3.00

Incoming places

Limited

Course description

Teaching methods

Learning outcome

- After passing this course successfully students are able to ...
- Analyze and discuss complex interdisciplinary problems in biomedical engineering in a broader context in a structured manner as part of a team.
 - Identify gaps in knowledge, conduct targeted research based on these gaps, evaluate and compare possible solutions, and develop their own proposed solutions.
 - to select, prepare and present own proposals for solutions and to

- defend them with scientific argumentation
- Explain and present the content and results of one's own or another's scientific publication in a comprehensible manner
 - Apply the basic rules of scientific work when writing and analyzing texts, distinguishing a scientific approach from a non-scientific (everyday world) approach.
 - explain common scientific procedures and methods in the respective subject and apply them in the context of scientific work under guidance, especially for natural science topics and experimental research methods
 - research selected scientific sources and cite them correctly in own texts
 - Explain and present the content and results of one's own or another's scientific publication in a comprehensible manner

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Current Topics in Life Science Engineering

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

Course description	In this course, students will attend a series of expert lectures from the entire field of Life Science Engineering. Life Science Engineering.
Teaching methods	Expert lectures, self-study with current articles and videos, feedback from lecturers, peer-review.
Learning outcome	After passing this course successfully students are able to ... - ...name different research topics in the field of Life Science

Engineering.

- ...conduct research on selected research topics in the field of Life Science Engineering.
- ...explain the results of research in the form of a short video.

Course contents

- Overview of tasks and activities in the subject areas of the study programme and beyond

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Photonics in Biomedical Engineering

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

Nuclear Medicine and Radiation Protection

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

Course description Basics of nuclear medicine and radiation protection

Teaching methods

Learning outcome After passing this course successfully students are able to ...
 - to describe examples from atomic, nuclear and radiation physics for

medical technology

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

Course contents

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

- Fundamentals of radiation biology
- Radiation damage, prevention and detection
- Dosimetry
- Fundamentals of radiation protection
- Legislation in the field of radiation protection
- Measuring instruments
- Medical and physical control
- Radiation accidents, first aid
- exercises: Handling of equipment for personal and Local dose determination including the use of Test lamps
- Radiopharmaceuticals and their production
- Dosimetry in nuclear medicine

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Web Based Medical Applications

Degree programme BBE

Semester 5

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description Main features, practical examples and state-of-the-art in the field of "Web-Based-Medical-Applications"

Teaching methods

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

- List common web-based medical applications and discuss their characteristics
- explain essential requirements for web-based medical applications
- Implement simple platform diagnostic solutions

Course contents - Basics of web development

- Basics of frontend and backend aspects of medical Systems
- Basic development opportunities of web-based solutions

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Mobile Computing in Medical Applications

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

Methods in Cell & Tissue Engineering

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

Course description The course provides an overview of current methods in Cell&Tissue Engineering

Teaching methods Self-study and presence phases alternate. In self-study, basic content is developed on the basis of the documents provided by the lecturers, in the presence phase these are discussed and deepened together.

Learning outcome After passing this course successfully students are able to ...
 - explain the basic principles of microscopy and the commonly used light (visible light and fluorescent light) and electron microscopy

techniques with their respective advantages and disadvantages

- give an overview of preclinical analysis methods and to compare and classify them for the field of tissue regeneration
- explain the basic steps involved in the preparation and characterization of tissue samples (e.g.: routine staining, immunohistochemistry, histomorphometry) and possible applications
- depict bioreactors schematically and explain the processes in these reactors
- describe the function, effect on cells, and advantages and disadvantages of biomaterials
- outline methods by which the genome of the cell can be modified and cell signaling pathways can be influenced

Course contents

- Basics of microscopy
- Electron microscopy
- Tissue FAXs and preclinical imaging
- Immunohistochemistry
- Molecular cloning
- Biomaterials, mechanical sensing and bioreactors

Prerequisites

Cell Culture Techniques Cel culture LabMolecular Genetics

Assessment Methods

- Entrance tests, group works and homeworks, final exam

Recommended Reading and Material

- Current documents are provided by the lecturers.

Attendance

There is a general requirement of 75% attendance. No reasons need to be proven or made credible for absenteeism within the remaining 25% (tolerance limit).

Comments

Project in Developmental Biology

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

Course description

The project provides insight into developmental biology. Central points include early development in mice, humans and zebrafish as

well as the role of stem cells in development. In the practical part at the end of the project, experiments on zebrafish embryos and larvae are performed and documented.

Teaching methods

Self-study and presence phases alternate; basics are worked out in the self-study phase, which are then discussed and deepened in the presence phase. At the end of the course, a staining of the blood vessel system of zebrafish in different stages will be performed in the laboratory.

Learning outcome

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

- Describe the processes of embryonic development, from fertilization to germ layer specification
- Compare early embryonic development stages of humans and mice
- Explain the basics of how the cells of our tissues and organs come to be specified and placed in their correct positions
- Understand the origin of the germ layers, the tissues that arise from them and thereby, the embryonic origin of different cell types
- Identify the master switches and stem cells that drive embryonic organ formation
- Understand how the knowledge of embryonic development can aid in in vitro cell differentiation
- Describe how stem cells contribute with which potential to the development and assess how to test for the distinct stem cell status
- Understand how these properties of stem cells can be used in research and in the development of the therapies
- Understand the principles of developmental biology, the development of zebrafish and of its blood vessels
- Generate templates for standard operating procedures from publications
- Conduct experiments on an important model system in developmental biology, the zebrafish

Course contents

- Early development of mouse and human
- Stem cells in development
- Zebrafish as a model system
- Classical Developmental Biology

Prerequisites

Course "Allgemeine Chemie" in the 1st semester

Assessment Methods

- entrance tests
- Moodle final exam
- report about laboratory project
- group assignments

Recommended Reading

- Current publications, slide sets, audio files are provided.

and Material

Attendance

In principle, attendance is compulsory to the extent of 75%. For absences within the remaining 25% (tolerance limit), no reasons need to be given.

Comments

Current Cell Technology Approaches

Degree programme BBE

Semester 5

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description

The course provides an insight into current approaches in cell technology such as protein- and RNA detection methods and tools for genome engineering and molecular forensics.

Teaching methods

Self-study phases and presence phases alternate. In self-study, the basics are developed with videos, documents etc. provided by the lecturers. This knowledge is discussed, tested, deepened and applied in group works in the presence phase.

Learning outcome

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

- name antibody-based analytical methods and explain their principles
- explain the process of reverse transcription and quantitative PCR and the detection principle of a qPCR
- design primers for qPCR applications and be able to evaluate RT-qPCR results
- outline approaches to introduce mutations into the genome of cells, explain components and mechanisms of the CRISPR/Cas9 tool, and give examples of current applications of genome engineering
- explain the main procedures and theoretical background of forensic DNA analysis and profiling
- list advantages and disadvantages of analytical approaches in forensics, and give an overview on common complications and appropriate troubleshooting strategies
- name procedures, applications and theoretical backgrounds for the

use of specific genetic markers in criminal prosecution and to select suitable markers depending on the task at hand

Course contents

- Western blot and ELISA
- RTqPCR
- Gene editing tools
- Molecular Forensics

Prerequisites

Instrumentelle Analytik in der Labormedizin Biochemie und Molekularbiologie Biochemie Labor Cell Culture Techniques

Assessment Methods

- Entrance tests, Group work, Moodle Final Exam

Recommended Reading and Material

- Current publications and documents will be provided by the lecturers; "Freshney's Culture of Animal Cells" (Edition 2021)

Attendance

There is a general requirement of 75% attendance. No reasons need to be proven or made credible for absenteeism within the remaining 25% (tolerance limit).

Comments

Applications of AAT

Degree programme

BBE

Semester

5

Course methods

ILV

Language

English

ECTS Credits

2.00

Incoming places

Limited

Course description

This hands-on course offers students an introduction to current application areas of Assistive and Accessible Technologies (AAT). Through an interactive workshop series, a variety of topics are explored – including Austrian Sign Language, accessibility with a focus on gender perspectives, and accessible gaming. The course aims to raise awareness of barriers, highlight the diversity of AAT, and encourage discussion of practical solutions with experts from the field.

Teaching methods

Workshops & Semester project

Learning outcome

- After passing this course successfully students are able to ...
- Describe key concepts and current application areas of Assistive and Accessible Technologies (AAT)

- Recognize and reflect on social and structural barriers faced by individuals with disabilities, with a focus on gender-specific challenges.
- Communicate basic concepts in Austrian Sign Language and understand its role as a cultural and communicative asset.
- Evaluate accessibility in digital environments, including the usability of games for people with different abilities.
- Engage in critical discussions on inclusive design and identify strategies for promoting accessibility in various fields.
- Collaborate with experts and apply interdisciplinary perspectives to real-world AAT challenges presented in the workshops.

Course contents

- Workshop: Austrian Sign Language (ÖGS) – basic principles, cultural context, nonverbal communication
- Workshop: Accessibility and gender – challenges and perspectives for women with disabilities
- Workshop: Accessible Gaming – inclusive game design, technical solutions, and user experiences
- Reflection on barriers in everyday life, digital environments, and education/work settings
- Interactive discussions with experts and individuals with lived experience
- Development of a critical understanding of inclusion and participatory design

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance mandatory

Comments

Assistive Technologies Plattformen

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

Course description	The course deals with relevant hardware and software technologies, including artificial intelligence, which are required for the specification and development of Assistive Technology solutions.
Teaching methods	* Presentations on the theory and functioning of technologies.* Many practical exercises involving input devices or software libraries and frameworks.* Assignments with programming tasks.
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - Analysing and evaluating existing technical solutions for people with disabilities and planning an appropriate solution (hardware and software components) - Selecting software libraries, frameworks and artificial intelligence models for assistive solutions - Exploring the potential of assistive applications in the areas of speech recognition, speech synthesis, LLMs and computer vision, and selecting technologies accordingly. - Assessing the efficiency and suitability of input devices using metrics
Course contents	<ul style="list-style-type: none"> - Testing and familiarising yourself with various input devices, including efficiency testing - Software libraries for speech synthesis, speech recognition, image processing/computer vision, LLMs - Application of the above-mentioned technologies in Assistive Technology systems and technological aids - Platforms and software frameworks in the field of assistive technologies

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Accessible Webtechnology

Degree programme	BBE
Semester	5
Course methods	ILV

Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	This course is conducted in coordination with "UX aspects of AAT". A UI prototype for a web application developed in "UX aspects" will be practically implemented in this course using Vue.js (HTML, CSS, and JavaScript). The focus is on an accessible frontend implementation based on WCAG criteria.
Teaching methods	Project-based and interdisciplinary teaching approach; instruction includes lectures, interactive mini-exercises, and coding demos
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - explain the technical fundamentals of a web application - prepare a UI prototype for implementation as a web app using a component-based approach - implement the frontend of a web app as a prototype using Vue.js (HTML, CSS, JS) - comply with key WCAG criteria for accessibility - assess the accessibility of a website using screen reader testing
Course contents	<ul style="list-style-type: none"> - technical fundamentals of web applications - basics of HTML, CSS, and JavaScript - fundamentals of the Vue.js framework - concepts for accessible web apps (e.g., semantic HTML, WCAG) - use of screen readers (e.g. NVDA) for accessibility testing
Prerequisites	none – however, the UI prototype developed in "UX aspects" is required
Assessment Methods	<ul style="list-style-type: none"> - project submission - project presentation - documentation of screen reader tests
Recommended Reading and Material	<ul style="list-style-type: none"> - see Moodle - various online resources and tutorials
Attendance	mandatory
Comments	
 UX aspects of AAT	
Degree programme	BBE
Semester	5

Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	This course covers the process of design and evaluation of products and services following the human centered design process. It aligns with and creates the frame for the course "Accessible Web Technologies"
Teaching methods	integrated course
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - explain the human centered design process - develop a prototype for an application according to goals - select an evaluation method of UX according to evaluation goals - plan and execute usability tests
Course contents	<ul style="list-style-type: none"> - Usability, UX - Accessibility, WCAG - Prototypes - Design guidelines - UX Evaluation methods - Usability Tests
Prerequisites	noneThe application created in "Accessible Web Technologies" will be used in the second half of the course.
Assessment Methods	- assignments
Recommended Reading and Material	<ul style="list-style-type: none"> - Moodle materials - online resources - via Moodle
Attendance	mandatory
Comments	

Basics of Assistive Technologies

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

Incoming places	Limited
Course description	Practice-oriented treatise on the subject of Active Assistive Technologies
Teaching methods	
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	attendance mandatory
Comments	

Biomedical in Silico Modeling and Simulation

Degree programme BBE

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

Course description Modelling and simulation is an emerging and growing field in the industry and in biomedical engineering in particular. With modelling and simulation techniques, it is possible to conduct research in areas that would not be possible in the traditional way. This can be for ethical, technical or even financial reasons. Examples of developments that are now often supported by modelling and simulation include pacemakers (for ethical and financial reasons), hip implants (for technical and ethical reasons), the development of new drugs and many more.

Teaching methods

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

- Model, simulate, and explain simple natural processes in biomedical engineering using ordinary differential equations.
- To explain the principle of the "read-across procedure".
- Grundlegende cardiovasculäre und respiratorische Modelle zu entwerfen und zur Nutzung einfacher Simulationen anzuwenden

Course contents

- Knowledge and skills to represent natural processes using modeling and simulation (e.g. cell growth, movements, muscle fibers,...).
- Skills in the use of numerical mathematics and the estimation of available results.
- Presentation and analysis of the results
- Read-Across procedure
- Conversion of biological processes into simplified mathematical models

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Neurorehabilitation

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

Course description Practical applications of neurorehabilitation

Teaching methods

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

- to be able to reproduce the not only technical equipment of a neurological rehabilitation centre, to explain the most frequent deficits and needs of the patients on site, and to reproduce the possibilities of a connection to their own professional orientation.
- to describe the functions of the human sensory organs and also frequently occurring damage, in order to develop suitable technical measures to compensate for failures.
- to be able to reproduce the physiological changes typically associated with the ageing process in order to design suitable technical measures to compensate for such failures.

Course contents

- Visual perception
- Auditory perception
- Tactile perception
- Aging

Prerequisites

Assessment Methods

- Lab Report
- Reflexion paper

Recommended Reading and Material

Attendance mandatory

Comments

Neural Engineering

Degree programme BBE

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

Course description

Teaching methods

Learning outcome

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

- To describe methods for recording action potentials in excitable tissue.
- Describe the differences between functional electrostimulation and neuromodulation in relation to spinal cord stimulation.
- design a stimulation protocol (parameters) for activating muscles and nerves.
- simulate and design electronic circuits for bioelectrical signals.
- Describe transcutaneous functional electrical stimulation for upper and lower extremities.
- Describe bioelectrical signals for neuroprosthetic systems, e.g. brain-computer interfaces.

Course contents

- Fundamentals of the electrophysiology of excitable nerve and muscle tissue
- electrical stimulation to restore or improve defective bodily functions
- Circuit design for necessary electronic devices, e.g. stimulators, biosignal amplifiers
- Circuit design for necessary electronic devices, e.g. stimulators, biosignal amplifiers
- Circuit design for necessary electronic devices, e.g. stimulators, biosignal amplifiers
- practical applications of functional electrostimulation
- Hands-on-Sessions

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Biomechanics

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

Course description The course's first block Biomechanics of Human Tissue focuses on the understanding of physiological and biomechanical principles underlying skeletal muscle force production. Furthermore, students learn to differentiate between human tissue such as bone, cartilage, muscle, tendons and ligaments, based on their mechanical properties. In Applied Biomechanics, the second block, students learn to mathematically solve biomechanical problems of both statics and dynamics such as calculating the joint forces during a lifting task.

Teaching methods

Learning outcome

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

- To describe the physiological and biomechanical principles underlying skeletal muscle force production
- To interpret and compare stress-strain diagrams of various materials
- To describe the mechanical properties of human tissue such as bone, cartilage, muscle, tendons and ligaments
- To mathematically solve biomechanical problems of statics and dynamics (e.g. calculation of force-distribution during lifting)

Course contents

- Rate coding and population coding in skeletal muscle
- Muscle fiber composition
- Force-length and force-velocity relationship
- Muscle architecture and moment arm
- Fundamental principles of stress, strain, elasticity and plasticity
- Mechanical properties of bone, cartilage, muscle, tendons and ligaments
- Fundamental principles of statics and dynamics
- Mathematical problems of statics and dynamics

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Medical Hospital Equipment

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

Course description Introduction in the field of "Medical Hospital Equipment"

Teaching methods

Learning outcome

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

- to present the most important aspects of blood compatibility and to identify critical points in the design of blood contacting components.
- describe the procedures of dialysis, haemofiltration, peritoneal dialysis and apheresis and compare them in their fields of application
- To describe the mode of operation of oxygenators and heart-lung machines and to justify the necessary alarm functions and possible side effects.
- to describe modern multifunctional pacemakers and to select them for different applications.
- To describe the design of respirators and discuss the function and possible malfunctions of the individual components.
- explain the functioning of external defibrillators and identify the potential hazards they pose and the influence they have on other medical devices.
- to apply procedures to optimise operating safety in concrete examples.

Course contents

- Aspects of blood compatibility of medical devices
- Technologies and equipment for blood purification and apheresis
- heart-lung machine and extracorporeal Membrane oxygenation
- Lung mechanics, ventilators and lung Support
- Complex pacemakers (Defi pacemakers, Multi-chamber systems, resynchronisation and de- remodelling method)
- Defibrillators

- Usability optimisation in medical devices (exercise)

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Sustainable Environmental and Bioprocess Engineering (BUB)

Trends in Bioprocess Technology

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

Course description This course informs students about current trends in bioprocess technology by presenting practical examples of innovative technologies and developments. Expert lectures offer in-depth insights into current topics in bioprocess technology, while excursions to companies offer the opportunity to experience and analyze bioprocess technologies in real applications.

Teaching methods

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

- Identify and describe innovative technologies and developments in bioprocess technology.
- Acquire in-depth knowledge of specific topics in bioprocess technology and understand interrelationships on the basis of specialist lectures by experts.
- To analyze bioprocess technologies in real applications through excursions to companies, to understand and evaluate concrete projects on site.

Course contents

- Current trends in bioprocess technology - practical applications of innovative technologies and developments
- In-depth study of current topics in bioprocess technology through specialist presentations by experts.
- Excursions to experience bioprocess technologies in real applications.

Prerequisites

Assessment Methods

- Moodle exam
- Excursion report

Recommended Reading and Material

Attendance 75% attendance compulsory

Comments

Bioprocess Engineering II

Degree programme BUB

Semester 5

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description

In this course, students deepen their knowledge in the field of bioprocess technology. The focus is on advanced processes in upstream processing, including process preparation and fermentation. In addition, advanced techniques in downstream processing are taught, addressing various aspects of fermentation broth characterization, concentration, product and biomass properties. In addition, general aspects of cell harvesting and cell disruption are covered, as well as the application of techniques such as adsorptive purification, precipitation and extraction.

Teaching methods

Learning outcome

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

- master in-depth aspects of upstream processing with regard to process preparation and fermentation.
- understand the properties of fermentation broths and the influence

of viscosity, density and biomass on processing.

- select specific methods of cell harvesting and explain their areas of application.

- understand chromatography as an adsorptive purification method understand the different types of chromatography.

- understand precipitation methods and the basics of extraction and influencing factors.

Course contents

- In-depth aspects of upstream processing for the accompanying laboratory exercises - Process preparation and fermentation
- Downstream processing: properties of fermentation broths, concentration, product, biomass viscosity, density and the influence on processing; in-depth study of cell harvesting and cell disruption; adsorptive purification: chromatography (in-depth); precipitation; extraction

Prerequisites

Bioprocess Engineering I

Assessment Methods

- Course-immanent
- final exam

Recommended Reading and Material

- Horst Chmiel: Bioprozesstechnik. Elsevier. 3rd edition (2011)

Attendance

75% attendance compulsory

Comments

Industry-Related Practical Project in Bioprocess Engineering

Degree programme

BUB

Semester

5

Course methods

PRJ

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

In this course, students acquire practical skills for solving real industrial problems. They apply theoretical knowledge in concrete situations, strengthen their teamwork and problem-solving skills, and improve their communication skills through collaboration with industry partners.

Teaching methods

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

- apply theoretical knowledge to real industrial challenges and develop practical solutions.
- integrate different aspects, including scientific/technical, economic, socio-economic and legal considerations, in the development and implementation of projects.
- demonstrate competencies in teamwork, particularly in the context of industrial project work.
- develop problem-solving skills through active involvement in solving real industrial problems, improving their communication skills.

Course contents

- practical experience in solving real industry problems
- application of theoretical knowledge to concrete situations, teamwork, problem-solving skills and communication with industry partners
- integration of scientific-technical, economic, socio-economic and legal aspects into the project work

Prerequisites

Assessment Methods

- Immanent assessment
- Collaboration in the project team
- Assessment of the project work

Recommended Reading and Material

Attendance 75% attendance compulsory

Comments

Ecotoxicology

Degree programme BUB

Semester 5

Course methods ILV

Language English

ECTS Credits 3.00

Incoming places Limited

Course description This course provides a comprehensive insight into the interactions between pollutants and living organisms in different environmental contexts. Students learn basic principles of ecotoxicology, identify pollutant sources, understand the transport mechanism and

distribution of pollutants in ecosystems. They also deal with the uptake, distribution and accumulation of pollutants in living organisms and the associated ecological effects and risk assessments.

Teaching methods

Learning outcome

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

- understand basic principles of ecotoxicology and the interactions between pollutants and living organisms.
- recognize different sources and types of pollutants and explain the mechanisms of pollutant transport and distribution in ecosystems.
- understand the processes of uptake, distribution and accumulation of pollutants in living organisms.
- become familiar with ecotoxicity endpoints and interpret dose-response curves.
- carry out basic risk assessments and evaluations in ecotoxicology.

Course contents

- General principles of ecotoxicology
- Pollutant sources and types
- Pollutant transport and distribution
- Uptake, distribution and accumulation
- Toxicological effects on organisms
- Effects on the ecosystem
- Dose-response curves
- Risk assessment and evaluation

Prerequisites

Assessment Methods

- Course-immanent
- Final module exam

Recommended Reading and Material

- Fent, K. (2013): Ökotoxikologie, Thieme Verlag
- Newman, M. (2014): Fundamentals of Ecotoxicology, Taylor & Francis Inc

Attendance

75% attendance compulsory

Comments

Green Biotechnology: Climate-Resilient Solutions

Degree programme BUB

Semester 5

Course methods ILV

Language English

ECTS Credits 3.00

Incoming places Limited

Course description This course provides a comprehensive insight into various aspects of biotechnology with a focus on environmental aspects. The focus is on sustainable applications in agriculture, environmental protection, genetic yield enhancement, ecological pest control, waste utilization, bioremediation and ethical aspects of biotechnology.

Teaching methods

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

- understand the basic principles of green biotechnology.
- understand the application of biotechnology in plant biotechnology and analyze its impact on food security.
- explain biotechnological approaches to waste recycling and resource optimization and identify their applications in different environmental contexts.
- analyze ethical issues related to biotechnological applications and critically evaluate different ethical perspectives.

Course contents

- Green biotechnology
- Plant biotechnology
- Biotechnology for food security
- Biological pest control
- Biotechnology in resource management
- Synthetic biology for environmental applications
- Ethics, sustainability, and challenges

Prerequisites Molekularbiologie und Biotechnologische Methoden Sustainable Environmental and Bioprocess Engineering

Assessment Methods

- Course-immanent
- Moodle exam at the end of the course

Recommended Reading and Material - Recent publications

Attendance 75% attendance compulsory

Comments

Industry-Related Practical Project in Environmental Engineering

Degree programme BUB

Semester 5

Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description In this course, students acquire practical skills for solving real industrial problems. They apply theoretical knowledge in concrete situations, strengthen their teamwork and problem-solving skills, and improve their communication skills through collaboration with industry partners.

Teaching methods

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

- apply theoretical knowledge to real industrial challenges and develop practical solutions.
- integrate different aspects, including scientific/technical, economic, socio-economic and legal considerations, in the development and implementation of projects.
- demonstrate competencies in teamwork, particularly in the context of industrial project work.
- develop problem-solving skills through active involvement in solving real industrial problems, improving their communication skills.

Course contents

- practical experience in solving real industry problems
- application of theoretical knowledge to concrete situations, teamwork, problem-solving skills and communication with industry partners
- integration of scientific-technical, economic, socio-economic and legal aspects into the project work

Prerequisites

Assessment Methods

- Immanent assessment
- Collaboration in the project team
- Assessment of the project work

Recommended Reading and Material

Attendance 75% attendance compulsory

Comments

Water, Air and Soil Management

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

Course description This course teaches the basic principles of urban water management, water protection, air pollution control and soil quality. Students learn technical procedures and legal framework conditions for the sustainable management of water, air and soil in an industrial and municipal context.

Teaching methods

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

- explain the principles and measures of urban and industrial water management, water protection and water management planning.
- apply process engineering measures for the efficient and sustainable use of water resources.
- explain state-of-the-art industrial processes for air pollution control and evaluate their use in various processes
- explain soil protection and soil remediation methods.
- Know specialist data sources and analyze and interpret water, air and soil data.

Course contents

- Fundamentals of urban and industrial water management, water protection and water management planning
- Principles and processes of water extraction, treatment, storage and distribution
- Measures to increase the efficiency of water use in a business/industrial and municipal context (closing the cycle, water re-use)
- Air pollutants, particulate matter and climate-relevant gas emissions
- Process engineering principles and procedures for air pollution control and limiting harmful emissions
- Soil quality and soil protection
- Soil remediation and remediation of contaminated sites
- Water, air and soil data management: determination, analysis and interpretation of data using GIS, WISA, eHYD, HORA, eBOD, contaminated site GIS, GeoSphere Austria, air quality values of the federal and state governments, etc.

Prerequisites

Assessment Methods - Course-immanent
- Final exam

Recommended Reading and Material - Fritsche, Hartmut: Fachwissen Umwelttechnik. Verlag Europa-Lehrmittel, Nourney, Vollmer GmbH & Co. KG, 2017

Attendance 75% attendance compulsory

Comments

Technical English

Degree programme BUB

Semester 1

Course methods UE

Language English

ECTS Credits 3.00

Incoming places Limited

Course description In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion

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

- record and employ technical vocabulary
- create and understand technical process instructions
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)

Course contents

- Understanding the importance of English in international technical communication
- Technical product descriptions

- Technical process descriptions
- Analysing and describing the impacts of technologies
- Formal writing and paragraph construction

Prerequisites

B2 level English

Assessment Methods

- Vocabulary Test (10%)
- Self-Study and Class Preparation (30%)
- Written Test (60%)

Recommended Reading and Material

- Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag.
- Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.

Attendance

Obligatory

Comments

Sustainable Environmental and Bioprocess Engineering

Degree programme

BUB

Semester

3

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

The course "Sustainable Environmental and Bioprocess Engineering" offers a comprehensive introduction to sustainable environmental and bioprocess engineering. Students acquire knowledge of bioreactors, process control, quality assurance in biotechnological processes as well as in environmental compartments, wastewater treatment and air pollution control. Practical examples from industry and current trends provide clear insights into the fields of application and developments in sustainable environmental and bioprocess technology. In addition, the course supports students in deciding on a further specialization from the 4th semester onwards.

Teaching methods

Learning outcome

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

- understand the basic principles of sustainable environmental and bioprocess engineering.

	- understand and analyze challenges in the fields of bioprocess engineering and environmental engineering.
Course contents	- Bioprocess technology: Basics of sustainable bioprocess technology; bioreactor design and process control; quality assurance in biotechnological processes; industrial applications and trends in sustainable bioprocess technology - Environmental technology: quality of environmental compartments: pollutants in water, air and soil; wastewater treatment; air pollution control; environmental law and requirements
Prerequisites	
Assessment Methods	- LV-immanent and final exam
Recommended Reading and Material	- Pauline M. Doran: Bioprocess Engineering Principles. Elsevier Science & Technology Books 2 (2013) - Bruce Rittmann und Perry McCarty: Environmental Biotechnology: Principles and Applications (2001)
Attendance	75% attendance compulsory
Comments	

International Business Engineering (BIW)

Manufacturing Engineering

Degree programme	BIW
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course students acquire basic knowledge in the fields of production engineering according to DIN 8580
Teaching methods	Integrated course
Learning outcome	After passing this course successfully students are able to ... - to specify essential industrial requirements 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

Materials Science

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

Course description In this course you will get an overview of the most important materials of our everyday life - have an insight into atomic levels, learn what these materials are capable of and what we use them for. Learn how to select the right material for a product design and carry out proper material tests in the laboratory course!

Teaching methods Our course consists of two sessions: the class and the self-study. During each class you will get information about some topics about material science. During the self-study you have to learn by yourself some additional information about materials. During some classes, you will have to write a test. The test will include the chapters, which were discussed during the class, as well as the chapters you had to

learn during your self-study. After having 4 classes and 4 self study sessions, you will attend a laboratory course, where you will carry out by yourself material tests.

Learning outcome

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

- to explain the basic properties of metallic materials (steel, cast iron, aluminium, copper, titanium, magnesium and their alloys) from a scientific and technical point of view, using practical industrial examples
- explain the basics of microscopy and electron microscopy
- to be able to make a simple material selection of metals
- To be able to name metallic materials.
- be able to enumerate metallic materials compared to plastics and ceramics as well as composite materials with advantages and disadvantages
- explain the basics of mechanical methods for testing materials as well as selected concrete test methods using appropriate technical terms and quantities (tensile test, hardness test, Charpy, Wöhler)

Course contents

- Terms (e.g. thermal expansion, modulus of elasticity, ...) and material properties
- Atomic decomposition & periodic table, chemical bonds
- Structure of metals (krz, kfz, hdp)
- Iron-carbon diagram
- Steel and cast iron
- Aluminium materials
- Copper Materials
- Titanium materials
- Magnesium materials
- Alloys, phase diagrams
- Electrochemistry especially corrosion of metallic materials
- Mechanical test methods (tensile test, notched bar impact bending test, hardness test, Wöhler test), PT, MT, VT; UT.
- effects of mechanical stress (e.g. deformation, work hardening)
- Interaction of material and production technology, example forging
- Basic principles of material selection (presentation of software tools)
- Differences of the material classes (metals, plastics, ceramics)
- Electron microscopic examination of various materials

Prerequisites

English language skills

Assessment Methods

- Written exam (Online)

Recommended Reading

- Ashby, M.F.; Jones, D.R.H.: Engineering Materials 1: An

and Material	Introduction to Properties, Applications and Design, Elsevier, 2011
Attendance	75%
Comments	More detailed information can be found in the Moodle course.

Technical English

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

Course description In the Technical English course, students will expand their language toolkit to allow them to effectively record and apply technical vocabulary and terminology in the context of future engineering projects. Students will also advance their technical verbal and written skills by creating technical product and technical process descriptions specifically for technical professional audiences and engineering purposes. Moreover, students will consider the impact of technology on their field and on the world in general.

Teaching methods small and medium tasks and activities; open class inputs and discussion; individual task completion settings; peer review and discussion

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

- record and employ technical vocabulary
- create and understand technical process instructions
- identify and produce technical text types according to their intended audience and communication purpose (for example a technical article and a process description)

Course contents

- Understanding the importance of English in international technical communication
- Technical product descriptions
- Technical process descriptions
- Analysing and describing the impacts of technologies
- Formal writing and paragraph construction

Prerequisites B2 level English

Assessment Methods	<ul style="list-style-type: none"> - Vocabulary Test (15%) - Self-Study and Class Preparation (25%) - Written Test (60%)
Recommended Reading and Material	<ul style="list-style-type: none"> - Murphy, R. (2019). English Grammar in Use, 5th Edition. Klett Verlag. - Oshima, A., Hogue, A. (2006). Writing Academic English, 4th Edition. Pearson Longman.
Attendance	Obligatory
Comments	

Industrial Informatics in a Digital Economy

Degree programme	BIW
Semester	5
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	After presentation of basic principles of Computer Science and Software Engineering they will be applied on sample applications of Digitization in concrete industrial environments (Software 4.0).
Teaching methods	
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - to apply basic principles of Computer Science and Software Engineering in industrial problem fields and projects - to adopt Requirements Engineering and Software Modeling for structured analysis and design - to elaborate sample applications of Digitization in a concrete environment - to identify, evaluate, select and introduce (Software) systems for industrial applications (using methodologic approaches for selecting appropriate options) - to understand principles of Software 4.0 (including Security & Safety), to apply adequate methods and to implement software solutions in industry
Course contents	<ul style="list-style-type: none"> - Computer Science Basics - Software Engineering

- Software Life Cycle
- Process models to develop Software (V-Model XT, Agile,...)
- DevOps (Operationalization of Software)
- Requirements Engineering & Software Modeling
- Software 4.0
- Digital Transformation in industry
- Reference architecture RAMI 4.
- Interoperability
- Security & Safety

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments none

Circular Economy and Sustainability

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

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

Teaching methods

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

- understand the fundamental concepts of sustainability; to be able to develop assessment criteria for monitoring sustainable development
- recognise the development and concept of circular economy; to acquire the professional vocabulary to develop a corporate culture of sustainability
- know about legal fundamentals at a European and national level
- be able to explain how a circular economy differs from the current linear system; to be able to explain how an economically successful

transition to a circular design is developed

- be able to classify the differences between "reuse", "remanufacturing" and "recycling" principles
- be able to explain the waste hierarchy and principles of waste prevention ("reduce") and Life Cycle Assessments (LCA)
- be able to plan and implement sustainable business models for circular economy
- understand the importance of engineers with regard to sustainable product design
- understand the need to adapt marketing and sales strategies for the circular economy
- be able to explain the international cycle of primary and secondary metal and raw material flows and the importance of anthropogenic deposits ("urban mining")
- be able to explain the principles of non-financial reporting by companies within the framework of the CSR Directive (Corporate Sustainability Reporting Directive) of the EU
- have an overview of sustainable financing models for companies and taxonomy.

Course contents

- Concept of sustainability
- Policies for sustainable and circular economy
- From linear to a circular economy (CE)
- Closing loops for a CE
- Business models for a CE
- Concepts for circular product design
- Thinking in global systems
- Green governance and sustainable finance

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Master DEGREE PROGRAMS

Internet of Things and Smart Systems (MIO)

Innovation- and Technolymanagement

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

Course description The course "Innovation- and Technolymanagement" offers you on the one hand current theory and practical examples of IT innovations, on the other hand you apply the learned theoretical knowledge practically by working on a problem defined by our corporate partner. This dual teaching approach provides the opportunity to learn practical skills in innovation development, prototyping and iterative work through user research to finally critically discuss solutions. At the end of the course, you will be proud of two outcomes: One, you will have developed and presented a prototype to solve our corporate partner's challenge. The core is the design of an innovation strategy, the creation of an implementation concept including accompanying measures based on a prototype. On the other hand, you will have written an individual knowledge contribution about an innovation or technology application.

Teaching methods Theory input from the lecturer
Group work with a predefined problem of a company
Discussion rounds
Written elaboration and reflection of contents

Learning outcome Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- plan and execute innovation strategies and processes
- critically discuss IT innovation tools and theories
- conduct a design sprint that specifically includes prototyping, user research, and iterative innovation processes
- evaluate and develop emerging technologies that induce innovation

Course contents

- Design thinking and design sprints
- Iterative work based on prototyping: from paper to digital prototypes

- Innovation organization & processes: Design of innovation processes and their implementation using concrete company examples.
- Theories (e.g. innovator's dilemma, open innovation, user lead innovation as well as co-creation approaches)
- Technology-induced innovation: models for evaluating technologies, technology radar, uncovering future trends
- Tools of IT innovation: playful approaches to IT innovation, innovation games; application of creativity techniques

Prerequisites

none

Assessment Methods

- Case Study "Innovation in an incumbent corporate": Application of theoretical knowledge in a practical application case; 50% of the total grade (group assessment)
- Creation of a knowledge contribution: 20% of the total grade (individual performance)
- Multiple Choice Exam 30% of the grade (individual performance)

Recommended Reading and Material

- Franken, R., & Franken, S. (2020). Wissen, Lernen und Innovation im digitalen Unternehmen (Vol. 2). Mit Fallstudien und Praxisbeispielen. Springer Gabler, Wiesbaden
- Bodemann, M., Fellner, W., & Just, V. (2021). Zukunftsfähigkeit durch Innovation, Digitalisierung und Technologien: Geschäftsmodelle und Unternehmenspraxis im Wandel, Springer Gabler, Wiesbaden

Attendance

The course will be taught at FH Technikum Wien. Collaboration tools will be integrated into the course sessions (e.g. lectures, group work). Moreover, the assessment methods (e.g. presentations, assignment) will be handled via Moodle. The current attendance rules are in effect.

Comments

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IoT System Models

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

Course description	The IoT System Models course covers the processing of the theoretical basis for the analysis and development of IoT systems.
Teaching methods	This ILV has been developed according to the "Constructive Alignment" principle. Each topic is processed in a distance learning and in a presence phase. These two phases complete each other and the main method in this ILV is "learning by doing". The distance learning is worked out by the students in self-study. Questions and open points are discussed in regular forums and meetings with the lecturer. In the attendance phase, the results of the distance learning are to be presented and the following topic is to be conveyed in the form of an impulse lecture.
Learning outcome	<p>Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...</p> <ul style="list-style-type: none"> - explain basic concepts and terms of IoT systems, - categorize and define IoT systems, - define common basic elements, properties and interfaces of IoT systems, - describe basics of Operation Technologies (OT) such as automation pyramid architecture as a basis for IIoT architectures, - understand and interpret key IoT standards and norms, - explain essential technologies on which IoT architectures are built (e.g. sensors, gateway, IT server, database), - specify requirements for the real-time capability (Real Time Operation) reliability, availability and safety (Security and Functional Safety) of IoT systems, - Specify elementary application-specific system architecture, define its interfaces, and implement it in the lab.
Course contents	<ul style="list-style-type: none"> - Introduction to IoT systems (definition, history, application areas, ...) - Categorization of IoT systems (Industrial IoT, Home Automation, ...) - Architecture of IoT systems (general and application-specific) - Infrastructure fundamentals - Standardization - Real-time capability - Fail-safe - Team project
Prerequisites	Basic knowledge according to acceptance criteria
Assessment Methods	<ul style="list-style-type: none"> - Immanent performance review (active participation/intermediate tests, 20%) - Team project, 40% (e.g., specify system architecture, define its interfaces, and present it as a team). - Final exam (theory, practical tasks, 40%)

Recommended Reading and Material	<ul style="list-style-type: none"> - Prof. Dr. rer. nat. Felix Hüning (2018), Embedded Systems für IoT, Springer Vieweg, © Springer-Verlag GmbH Deutschland - Prof. Dr. Steffen Wendzel (2018), IT-Sicherheit für TCP/IP- und IoT-Netzwerke, Springer Vieweg, © Springer-Verlag GmbH Deutschland - David Hanes, Gonzalo Salgueiro et. al., IoT Fundamentals, Cisco Press, ISBN-13: 978-1-58714-456-1, 2017 Cisco Systems
Attendance	Optional (with full attendance + 20% from active participation).
Comments	

Networking

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

Course description This course discusses network technologies that form the basis for data communication in IoT systems.

Teaching methods

Learning outcome Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- plan, describe and apply architecture, protocol stacks, interfaces, addresses, routing, ... of IPv4 networks.
- describe the basic network architectures and communication protocols used in LANs and WANs, reference models, and their message flows.
- name and explain routing concepts, DNS, DHCP, firewalls, ACLs.
- simulate/emulate IP networks and protocols in a simulation environment.
- explain the operation of internetworking devices (hub, switch, router)
- explain the concepts of NFV, SDN, and the "cloudification" of communication networks.
- configure network elements in a simulator or in practice
- configure and operate server infrastructure for network services
- analyze protocol headers
- apply network standard tools such as Wireshark and PuTTY

- Course contents**
- Reference models (OSI, TCP/IP), network architectures and communication protocols in LANs and WANs
 - Message flows in communication networks
 - Configuration of network elements and server infrastructures
 - Planning of LANs and IP networks (TCP/IP)
 - Configure and manage DNS and DHCP servers
 - Configuration of Firewalls and ACLs
 - Routing, Internetworking
 - Simulation of LANs and IP networks
 - Functional analysis and troubleshooting in LANs
 - NFV and SDN

Prerequisites

- Assessment Methods**
- Assessment of laboratory exercises/simulation exercises documented by students in laboratory protocols.
 - Presentation of a relevant topic
 - Moodle-Quiz
 - Oral examination

Recommended Reading and Material

Attendance

Comments

IoT Operating Systems

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

Course description

In this course IoT operating systems will be discussed. We start with a short review of bare-metal microcontroller programming in C (ESP32), followed by the programming of FreeRTOS based sensor nodes (ESP32), concluding the lecture with Linux as operating system for gateways and servers.

Teaching methods

This course employs theory lecture's, practical demonstrations and practical exercises.

Learning outcome	<p>Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...</p> <ul style="list-style-type: none"> - explain basic operating system functions, such as the process model and virtual memory management. - use Linux systems via the command line, as well as automate more complex tasks with shell scripts. - configure the network stack of Linux systems. - configure persistent mass storage (HDDs, SSDs, e.g.) on Linux systems. - implement container virtualization on Linux. - explain the similarities and differences between General Purpose Operating System (GPOS) and Real Time Operating System (RTOS). - select the appropriate RTOS services, task models, scheduling methods and design patterns for embedded software applications and to employ debugging strategies for embedded real-time operating systems.
Course contents	<ul style="list-style-type: none"> - Operating systems basics (processes, memory management) - Shell and system programs - GNU/Linux installation (boot process on ARM and x86 architectures, block devices, file systems) - GNU/Linux configuration (user management, network stack) - Basics of virtualization (virtual machines, containers, virtual networks) - GPOS vs. RTOS, RTOS characteristics - Tasks and scheduling in RTOS - Intertask Communication and Synchronization - Exception processing (exceptions, interrupts) - Timer and Timer Services - Task models, cycle-based scheduling
Prerequisites	Microcontroller programming in C/User knowledge in Linux
Assessment Methods	<ul style="list-style-type: none"> - Weekly homework - Two written exams
Recommended Reading and Material	
Attendance	optional
Comments	

Mobile and Wireless Systems

Degree programme MIO

Semester	1
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited
Course description	The scope of this lecture are the basics, necessary for wireless data transmission and communication
Teaching methods	Presentation Exercises Simulation Study of provided material and references
Learning outcome	<p>Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...</p> <ul style="list-style-type: none"> - understand the basics of wave propagation - understand the elements a transmission path or circuit - understand the implementation of cellular communication networks, the related procedures like connection Setup, Authentication, Authorization, Handover and the associated signaling between the involved network elements - calculate the coverage and the capacity of the air interface - understand technologies like, digital modulation-, multiple access-, duplex-schemas, antenna technologies, MIMO and the associated mathematical basics in this context - understand the concepts of NFV, SDN, and Network Slicing as applied in 5G - understand the concepts of Low Power Wide Area Networks, their applicability and the aspects necessary to be considered in context of application development - understand the necessity of a standardized software middle layer, in respect of scalability and interoperability in context of application development
Course contents	<ul style="list-style-type: none"> - Network- architectures and elements as well as the associated protocols as used in (GSM, GPRS, 3G, LTE, 5G..) - Cellular technologies for IoT devices (NB-IoT, LTE Cat-M, Lora) - Procedures and signaling of cellular communication systems - Physical aspects of the Air interface and related technologies for the data transmission over a wireless channel (CDMA, OFDMA, MIMO etc..) - NFV, SDN and Network Slicing - Standardized Software components (oneM2M, LwM2M) to ensure interoperability of applications

Prerequisites	Basic mathematical skills in:(x.) Fourier series(x.) Fourier transform(x.) Trigonometric functions
Assessment Methods	- two written exams
Recommended Reading and Material	
Attendance	
Comments	

Data Management

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

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

Teaching methods

Learning outcome Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

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

Course contents - Database Basics and Technologies

- Data modeling and database creation
- Data manipulation
- Queries using SQL
- XML and JSON
- NoSQL databases for time series data
- Big Data Infrastructures

Prerequisites

Assessment Methods - 3 partial exams (100%)

Recommended Reading and Material

Attendance

Comments

Scientific Work

Degree programme	MIO
Semester	3
Course methods	SE
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- understand the peculiarities of the scientific way of working and recognize the quality characteristics of a scientific paper.
- create the structure of a Master's thesis based on the "Guidelines for writing a Bachelor's thesis or Master's thesis" of the University of Applied Sciences Technikum Wien.
- organize the content of the main sections of a master's thesis in such a way that they meet the requirements of a scientific paper.
- plan and conduct relevant research activities.
- survey the state of the art in a subject area, conduct a literature search for a scientific question, and document the results.
- make correct scientific citations as well as recognize the differences between verbatim citations, referencing, and plagiarism.

- formulate research questions and hypotheses.
- carry out the correct choice of scientific methods for a research question.
- develop a research design and document it graphically and methodically using a flow chart.
- evaluate the quality of references and data sources.
- present the results in a lecture.

Course contents

- Structure of scientific papers and theses
- Quality characteristics of a scientific paper
- Structure and sections of a master's thesis
- Research questions and hypotheses
- Collection of empirical data
- Scientific methods and their correct application
- State of the art/related work section
- Literature search and review
- Correct citation

Prerequisites

Previous experience from writing the bachelor thesis

Assessment Methods

- Evaluation of practical tasks and final examination

Recommended Reading and Material

- Günter Essl, Karl Göschka, Susanne Teschl (2018), Leitfaden zur Verfassung einer Bachelorarbeit oder Masterarbeit
- Skern, T. (2011 ff), Writing scientific English: A workbook, Xnd. ed, Facultas Verlag, Wien

Attendance

mandatory

Comments

Digital Leadership

Degree programme

MIO

Semester

3

Course methods

SE

Language

German

ECTS Credits

5.00

Incoming places

Limited

Course description

This course will provide an overview of the latest practical and theoretical leadership concepts. Students will gain practical insights into the challenges of leadership and transformation, for example, in international organizations, and they will also develop new

perspectives on the contemporary world of work and the theme of leadership. One of the course's fundamental components will be a student created reflection on specific issues concerning leadership and their implementation.

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

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

Course contents

- Fundamentals of leadership, traditional traits, behavioural and situational theories of leadership
- Systems theory in social systems
- Leadership in a digital context
- Modern leadership concepts (agile leadership, transformational leadership, servant leadership and other such theories)
- Interdisciplinarity and interculturality
- Trends in the economy: the labour market, globalisation, digital transformation and Industry 4.0
- The specifics of leading teams of experts

Prerequisites

Assessment Methods

- Participation in workshops, exercises, case studies, written exam

Recommended Reading and Material

- Berninger-Schäfer, E. (2019): Digital Leadership; Die Digitalisierung der Führung, managerSeminare Verlags GmbH
- Franken, S. (2019): Verhaltensorientierte Führung; Handeln, Lernen und Ethik im Unternehmen, 4. Auflage, Gabler

- Gasteiger, R., Kaschube, J., Rathjen, Ph. (2016): Interkulturelle Führung in Organisationen, Menschen in globalen Kontexten effektiv führen, essentials Springer Gabal
- Greßer, K., Freisler, R. (2020): Ready for Transformation; Neue Arbeitswelt, digital und agil..., managerSeminare Verlags GmbH
- Lerch, Sebastian (2017): Interdisziplinäre Kompetenzen, UTB
- Lüthi, E., Oberpriller, H., Loose, A., Orths, St. (2013): Teamentwicklung mit Diversity Management, Haupt
- Wunderer, R. (2011): Führung und Zusammenarbeit, Eine unternehmerische Führungslehre, 9. Auflage, Luchterhand

Attendance

Attendance is compulsory.

Comments

Digital Business Modelling

Degree programme	MIO
Semester	3
Course methods	SE
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

- Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...
- name and describe the components of a business model
 - analyze business models in terms of strengths, weaknesses, opportunities and threats
 - develop business model innovations based on trends and customer needs
 - optimize business models through the use of digital technologies
 - systematically implement (digital) business model innovations

Course contents

- Megatrends
- Business idea
- Business model term
- Types of business models
- Digital business models

- Business model development
- Business Model Canvas
- Design Thinking
- Prototyping
- Business Model Assessment
- Business Model Assessment

Prerequisites

Assessment Methods - Project work (100 points)

Recommended Reading and Material

- Wala, Thomas. Innovations- und Technologiemanagement (2020)
- Alexander Osterwalder, Yves Pigneur. Business Modell Generation (2010)
- Alexander Osterwalder, Yves Pigneur, Greg Bernarda, Alan Smith. Value Proposition Design (2014)

Attendance

Comments **The course will take place only if a sufficient number of regular students register**

Software Development Processes

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- argue differences between iterative (spiral model, V-model), procedural and agile process models (SCRUM, KANBAN, ...) and evaluate their strengths and weaknesses
- select appropriate software process models for concrete IT application areas, adapt process flows taking into account general framework conditions (process tailoring, reference model) and compile project-specific processes, activities, results, roles, etc. (project tailoring).

- identify, evaluate and assess suitable software engineering methods and tools (in application lifecycle management, requirements, change and test management) for specific use cases in IoT development and select and propose adequate solutions.
- define a team-oriented, integrated process improvement approach to software development and operations (DevOps) and implement DevOps methods (Continuous Integration, Continuous Delivery, ...) with tool support in the application lifecycle of IoT solutions.
- build and commission a DevOps platform and plan and implement a concrete IoT application example on it.

Course contents

- Basics Software Lifecycle (software development processes, procedure models)
- Agile process models (SCRUM, KANBAN)
- Application Lifecycle Management (ALM)
- Basics Development & Operations (DevOps)
- Continuous integration, continuous delivery
- Setup and application of a DevOps platform based on IoT software solutions

Prerequisites

Assessment Methods

- LV-immanent performance assessment and final examination

Recommended Reading and Material

- Sommerville, I., 2018. Software Engineering, 10., aktualisierte Auflage. it - informatik. Pearson, Hallbergmoos
- Kim, G., Humble, J., Debois, P., Willis, J., 2017. Das DevOps-Handbuch: Teams, Tools und Infrastrukturen erfolgreich umgestalten, 1. Auflage. O'Reilly, Heidelberg

Attendance

Comments

The course will take place only if a sufficient number of regular students register

Advanced Networking

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- Understand and implement IP routing concepts, MPLS and VPN services.
- Explain and implement modern network management methods such as SNMP, Software Defined Networking, and Network Function Virtualization.
- plan and implement IPv6-networks
- perform a tool-supported network and protocol analysis
- Find and correct network anomalies
- Secure networks and close common gateways

Course contents

- Configuration of network elements and server infrastructures
- Planing of LANs, WANs und IP networks
- IP Routing protocols (OSPF, BGP)
- MPLS and VPN Services
- Management of IP networks, SNMP
- Software Defined Networking und Netzwerkfunktionsvirtualisierung
- Configuration and operation of network analysis tools
- Analysis and evaluation of data traffic
- Detection, analysis and elimination of network anomalies (troubleshooting)

Prerequisites

Assessment Methods

- assessment of laboratory exercises/simulation exercises documented by students in laboratory protocols
- reflection discussion on the lab protocol/assignment with the lector(s).
- presentation of a relevant topic
- moodle quiz
- exam

Recommended Reading and Material

- relevant IETF RFCs
- Selected white papers from network component manufacturers
- Valentin Plenk (2017), Angewandte Netzwerktechnik kompakt
- Laura Chappell (2013), Wireshark 101: Essential Skills for Network Analysis
- Kent Hundley: Alcatel-Lucent Scalable IP Networks Self-Study Guide; Wiley Publishing Inc. 2009

Attendance

Comments

The course will take place only if a sufficient number of regular

students register

App Development

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- describe the architecture and features of the platforms and correctly apply design patterns and APIs, taking into account UX standards.
- Design and develop an app for IoT specific use cases (using Android Studio or Xcode).
- implement interfaces to IoT systems
- install and test the app in the emulator and on the hardware
- publish an app to the app store in compliance with all guidelines

Course contents

- App specific design patterns and APIs
- Android Studio, Xcode and debugging tools (Java or Kotlin and SwiftUI)
- Implementation of an Android and iOS app

Prerequisites

Assessment Methods

- LV-immanent performance assessment
- moodle quiz
- Presentation and discussion of the developed app

Recommended Reading and Material

- Apple Developer Page: <https://developer.apple.com/documentation>
- Android Developer Page: <https://developer.android.com>
- Udacity course: Advances Android with Kotlin
- Swift Book: <https://docs.swift.org/swift-book/>
- Swift Tutorial: How To Master The Fundamentals (2020): <https://codewithchris.com/swift-tutorial-complete/>

Attendance

Comments

The course will take place only if a sufficient number of regular

students register

Embedded Security

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome

Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- be able to explain the main exploit mitigation techniques and assess their advantages and disadvantages
- perform commissioning and configuration of hardware security features in selected MCUs.
- evaluate the availability of security features in embedded operating systems
- select compilers based on their support of security features
- implement best practices related to Security Aware Software Development for Embedded Systems.

Course contents

- Exploit Mitigation in Embedded IoT Firmware
- Sensitive information protection mechanisms modern microcontroller
- Hardware security features of modern MCUs
- Security features in embedded operating systems

Prerequisites

Assessment Methods

- Practice Deliveries
- Delivery talks

Recommended Reading and Material

- Pinto, Sandro, and Nuno Santos. „Demystifying ARM Trustzone: A Comprehensive Survey.“, ACM Computing Surveys (CSUR) 51.6 (2019), 1-36.
- Obermaier, Johannes; Tatschner, Stefan. „Shedding too Much Light on a Microcontroller's Firmware Protection“, 11th USENIX Workshop on Offensive Technologies (WOOT17), 2017.
- Abbasi, A., Wetzels, J., Holz, T., & Etalle, S. „Challenges in

Designing Exploit Mitigations for Deeply Embedded Systems“. IEEE European Symposium on Security and Privacy (EuroS&P), 2019, 31-46.

Attendance

Comments **The course will take place only if a sufficient number of regular students register**

Sensor Data Analytics

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

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

Course contents

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

- Predictive analytics using pattern recognition

Prerequisites

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

- Recommended Reading and Material**
- Burkov, A. (2019). The Hundred-Page Machine Learning Book. Burkov

Attendance

Comments **The course will take place only if a sufficient number of regular students register**

Automation

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

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

- Course contents**
- Switch-on delay, switch-off delay, staircase automat, comfort switching
 - Circuits and components from practice (e.g. counter for wind measurement, anti-ice function for roller shutters, temperature sensors, motion detectors, humidity sensor)

- Control of ventilation technology, dehumidification technology
- Linking of individual elements and the problems behind it
- Automatic doors and gate controls
- Plant engineering in the industry
- Autonomous driving with guidance systems in / on the ground or with AI
- Basics of engine control units - characteristics and control of the individual types
- Problems of instability of controls in large plants
- Manipulated variable and its significance in building services engineering
- Manipulated variable and its significance in building technology
- Maintenance and repair, troubleshooting and analysis

Prerequisites

Assessment Methods - Ongoing practical examples and final theoretical exam

Recommended Reading and Material

- Heinrich, Linke, Glöckler (2020): Grundlagen Automatisierung, Springer Verlag.
- V. Plenk, Grundlagen der Automatisierungstechnik kompakt, Springer Verlag Vieweg, 2019.
- Wellenreuther, Zastrow (2015): Automatisieren mit SPS, Springer Vieweg.
- Tapken (2020): SPS – Theorie und Praxis, Europa-Lehrmittel.
- C. Karaali, Grundlagen der Steuerungstechnik, Springer Verlag Vieweg, 2018.

Attendance

Comments

Advanced IoT Operating Systems

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome	Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ... <ul style="list-style-type: none"> - create virtual computer networks under Linux - limit the memory consumption of processes under Linux with CGROUPS - implement basic network services (DNS, Web, SSH servers) on Linux systems - implement network services in containers - use configuration management tools to manage remote systems
Course contents	<ul style="list-style-type: none"> - virtual network interfaces under Linux - resource management with CGROUPS under Linux - basic network services (DNS, web, SSH servers) - creating and operating containers under Linux - use of configuration management tools - software design for data throughput (interrupt frequency, pipelined software, DMA, ...) - buffering, producer-consumer problem - in-field online management of embedded devices
Prerequisites	
Assessment Methods	- course immanent performance assessment and final examination
Recommended Reading and Material	- lectures notes
Attendance	
Comments	The course will take place only if a sufficient number of regular students register

Advanced IoT Systems Development

Degree programme	MIO
Semester	3
Course methods	ILV
Language	German
ECTS Credits	5.00
Incoming places	Limited

Course description

Teaching methods

Learning outcome Nach erfolgreichem Abschluss sind die Studierenden in der Lage, ...

- design, implement, and optimize end-to-end IoT systems.
- select appropriate algorithms and architectures to implement distributed IoT systems.
- select and use suitable cloud backends

Course contents

- design & programming of distributed IoT overall systems
- selection of suitable components and tools
- Comparison and selection of algorithms
- distributed calculations in the overall system
- evaluation of different solution approaches and selection of the appropriate architecture
- optimization of the algorithms, the communication structure and the overall architecture

Prerequisites

Assessment Methods

- course immanent performance assessment and final examination

Recommended Reading and Material

Attendance

Comments

The course will take place only if a sufficient number of regular students register

Medical Engineering & eHealth (MME)

Modelling in Cardiovascular Systems

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

Course description

This course provides basic knowledge of cardiovascular system dynamics, in particular focusing on the numerical and computational fluid dynamic modeling of cardiac (patho)physiology and mechanical circulatory assistance.

Teaching methods

Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - explain the basics of cardiovascular system dynamics - explain the basics of modeling of dynamical systems using analogies - solve (numerically) differential equations that model cardiovascular systems using Simulink - autonomously build numerical models of the cardiovascular system
Course contents	<ul style="list-style-type: none"> - Selection from: - Introduction to blood flow hydrodynamics - Introduction to cardiac and vascular biomechanics - Introduction into compartmental models modeling through analogies - Modeling of cardiac mechanics - Modeling of vascular mechanics - Modeling of lung mechanics - Modeling of ventricular assist devices and cardiovascular interaction
Prerequisites	<ul style="list-style-type: none"> - Basic knowledge of Matlab and Simulink- Basic understanding of first and second order linear ordinary differential equations- Basics of cardiovascular anatomy and physiology
Assessment Methods	<ul style="list-style-type: none"> - Intermediate assignments requiring a written report of the student work - Final written exam
Recommended Reading and Material	<ul style="list-style-type: none"> - BOOKS (comprehensive references marked with *): - Guyton AC, Hall JE. (2006) Textbook of medical physiology. 11th ed. Elsevier Saunders. * - Milnor WR. (1989) Hemodynamics. 2nd ed. Williams & Wilkins. - Nichols WW, O'Rourke MF. (2005) McDonald's blood flow in arteries. 5th ed. Hodder Arnold. - Sagawa K, Maughan L, Suga H, Sunagawa K. (1988) Cardiac Contraction and the Pressure-Volume Relationship. Oxford Univ. Press. - Scherf HE. Modellbildung und Simulation dynamischer Systeme (2007). 3. Auflage. Oldenburg Verlag. * - Werner J (2014) Biomedizinische Technik - Automatisierte Therapiesysteme. Band 9. De Gruyter. * - West JB. (2008) Respiratory physiology: the essentials. 8th ed. Lippincott Williams & Wilkins. - Zipes DP, Libby P, Bonow R, Braunwald E. (2004) Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. 7th ed.

Saunders.PAPERS:

- Carabello BA. Evolution of the study of left ventricular function: Everything old is new again. 2002 Circulation 105(23):2701-3.
- Westerhof N, Lankhaar JW, Westerhof BE. The arterial Windkessel. Med Biol Eng Comput. 2009;47(2):131-41.ONLINE DOCUMENTS (very informative about the key concepts of cardiovascular dynamics):
- Burkhoff D. 2002. Mechanical Properties Of The Heart And Its Interaction With The Vascular System. Columbia University, NY (www.columbia.edu/itc/hs/medical/heartsim/review.pdf)
- Mark RG. 2004. CARDIOVASCULAR MECHANICS I, II, III. MASSACHUSETTS INSTITUTE OF TECHNOLOGY (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-542j-quantitative-physiology-organ-transport-systems-spring-2004/readings/cardio_mech.pdf)

Attendance Attendance is compulsory

Comments

Workflows and Communication

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

Course description The course provides an overview of workflows in healthcare systems, focusing on distributed and shared workflows within healthcare providers. Typical workflow examples are introduced, along with communication skills relevant to healthcare settings. The content aligns with the PRT course and incorporates perspectives from partner universities and institutions.

Teaching methods Lectures, self guided research, hands on experience in the lab, virtual visits to labs and healthcare provider sites and site visits (if possible). Creating a case study.

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

- Describe and analyse existing workflows with the help of literature

(standards, publications, medical guidelines, product documentation, etc.)

- Select structured methods for assessing the perspectives of different stakeholders (doctors, nurses, patients, administration, etc.) and apply them in simplified examples.
- Describing workflows in healthcare from a technical perspective as requirements using simplified examples

Course contents

- Workflows in medicine
- Clinical guidelines and technical standards
- Fundamentals of communication, roles, communication channels

Prerequisites

none

Assessment Methods

- Case study

Recommended Reading and Material

- Melinda M Davis et al: Clinical Workflows and the Associated Tasks and Behaviors to Support Delivery of Integrated Behavioral Health and Primary Care. J Ambul Care Manage. Author manuscript; available in PMC 2020 January 01. Published in final edited form as: J Ambul Care Manage. 2019 ; 42(1): 51–65. doi:10.1097/JAC.000000000000257. Available online (10.7.2025) <https://pmc.ncbi.nlm.nih.gov/articles/PMC6278604/pdf/nihms-981753.pdf>
- Häcker, H.; Stapf, K. H.: Dorsch Psychologisches Wörterbuch, 1994
- Rupperecht, Werner: Einführung in die Theorie der kognitiven Kommunikation, 2014

Attendance

Comments

Digital Leadership

Degree programme MME

Semester 1

Course methods UE

Language English

ECTS Credits 2.00

Incoming places Limited

Course description

The course provides students with an overview of the current state of digital leadership in terms of both theory and practice. Students gain

insights into the current leadership and transformation challenges, e.g., in international organizations, and develop a new perspective on the current working world and the topic of leadership. An important part of the course is the students' own reflection on selected topics.

Teaching methods

Workshops, exercises, case studies, written exam

Learning outcome

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

- Identify and explain leadership tasks and tools (e.g., delegation, goal setting) and explain classic leadership models (e.g., leadership continuum, maturity model), weigh their advantages and disadvantages, and apply them to practical examples.
- Describe agile leadership (e.g., in expert organizations, transformation processes) and apply it using examples.
- Explain the concept of digital leadership (e.g., coaching culture) and apply it to specific cases.
- understanding the essential leadership techniques in an intercultural context
- Motivating employees and leading virtual teams in an increasingly digitalized work environment

Course contents

- Fundamentals of leadership, traditional trait, behavioral, and situational theories of leadership
- Leadership in the digital context
- Modern leadership concepts (agile leadership, transformational leadership, servant leadership, etc.)
- Trends in the economy: labor market, globalization, digital transformation, and Industry 4.0

Prerequisites

none

Assessment Methods

- 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
- Wunderer, R. (2011): Führung und Zusammenarbeit, Eine

unternehmerische Führungslehre, 9. Auflage, Luchterhand

Attendance mandatory

Comments

Respiration Technologies

Degree programme MME

Semester 1

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description This course focuses on respiration technologies, beginning with an overview of the human respiratory system. It explores various aspects of mechanical ventilation, including device construction, operational modes, and applications. The course also covers lung simulation and its significance in medical engineering. Additionally, it examines the production and measurement of aerosols, emphasizing their role in treating respiratory diseases. Each theoretical topic is complemented by practical exercises, demonstrations, or laboratory activities, effectively bridging theory with hands-on experience.

Teaching methods Lectures complemented by practical assignments and laboratory exercises

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

- Assess pulmonary system testing methods
- Understand the design, components, and operation of medical ventilator systems
- Differentiate mechanical ventilation modes
- Identify and explain different methods of lung simulation
- Implement computational lung modeling approaches and their applications in respiratory research
- Explain aerosol production and measurement techniques and apply them practically

Course contents

- Introduction
- Pulmonary System Testing
- Medical Ventilator Systems
- Mechanical Ventilation Modes

- Lung Simulation
- In Silico Lung Modelling
- Aerosol Production
- Aerosol Measurement
- Ventilation Devices & Methods Laboratory
- Aerosol Production & Measurements Laboratory
- Research @FHTW & Journal Club

Prerequisites Lung Anatomy and Physiology, Basics in Fluid Dynamics

Assessment Methods

- Exercises (45%)
- Laboratory Protocols (45%)
- Presentation (10%)

Recommended Reading and Material - Teaching material in the moodle course

Attendance Attendance in “Lecture” blocks is optional 100% mandatory attendance for “Laboratory” course blocks

Comments

Advanced Programming for Medicine

Degree programme MME

Semester 1

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description In this course, students will gain hands-on experience in implementing interoperability solutions for healthcare IT. They will learn to interpret and apply existing specifications, such as FHIR and HL7 CDA Implementation Guides, and to develop software applications that comply with these standards. The course emphasizes practical problem-solving by incorporating real-world scenarios and industry-relevant frameworks, particularly from the IHE Technical Frameworks (IT-Infrastructure domain).

Teaching methods This course follows an agile development approach. In individual sprints, student groups are tasked with implementing HL7 FHIR functionalities, HL7 CDA import tools, and OMOP-compatible export tools.

Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - design and implement client applications capable of interacting with RESTful FHIR services, including querying and managing healthcare data - adapt and modify CDA documents according to existing CDA Implementation Guides - develop client applications to read, modify, and generate HL7 CDA documents based on provided templates - apply debugging and validation techniques to ensure compliance with healthcare interoperability standards. - implement client applications capable of transforming and exporting health data in OMOP-compliant formats.
Course contents	<ul style="list-style-type: none"> - Support in the implementation of RESTful interfaces for the exchange of FHIR resources - Support in the implementation of CDA import/export functionalities - Support in the implementation of mapping algorithms from FHIR to OMOP
Prerequisites	<p>Basic programming skills (e.g., Java, C#, Python). Attention! It is strongly recommended to select the course Medical Information Systems, as the necessary theoretical knowledge is covered there.</p>
Assessment Methods	<ul style="list-style-type: none"> - Sprint outcomes – individual – 40% - Final presentation – group level – 30% - Questions and code review – individual, as part of the final presentation – 30%
Recommended Reading and Material	
Attendance	<p>mandatory</p>
Comments	<p>Due to its strong connection to the theoretical foundations covered in Medical Information Systems (MIS), this course should only be taken by students who are also enrolled in MIS or have prior knowledge of its content</p>

Medical Information Systems

Degree programme	MME
Semester	1
Course methods	ILV
Language	English

ECTS Credits 5.00

Incoming places Limited

Course description This course covers relevant communication standards for both the primary and secondary use of medical data. In addition, initiatives that drive and shape standardized data exchange are introduced. The application of these standardized communication methods is demonstrated using the Austrian electronic health record system, ELGA. Standardization enables the seamless integration of healthcare systems and applications and provides the framework for scalable, future-proof solutions.

Teaching methods This course primarily consists of lectures and discussions based on the presented content. Quizzes (not graded) allow for reflection on the acquired knowledge. Graded components include two practical assignments, which must be completed during the course sessions, as well as a theoretical final exam.

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

- describe FHIR basics (IGs, Profiles, Artefacts)
- describe basic structure of CDA documents
- describe datatypes, terminologies, and reference information model of HL7 V3
- use the basic terminologies of IHE
- explain the processes of the IHE Connectathon and the requirements
- describe the basic process of documented exchange in XDS
- describe the IHE Cross-Community Profiles work (based on XCA, XCPD)
- describe Identity Management in IHE (based on PIX, PDQ)
- describe basic security concepts in the context of the course
- describe the basics of IT-Security according IHE Security Profiles (CT, ATNA, XUA, BPPC)
- describe the Architecture and Security Requirements of ELGA
- describe differences between primary and secondary use of data
- explain the motivation of OMOP and discuss the integration in existing HIE systems

Course contents

- HL7 communication standards - FHIR und CDA
- Integrating the Healthcare Enterprise (IHE) Initiative
- OHSDI OMOP
- ELGA
- Security Basics

Prerequisites There are no formal prerequisites for this course. However, students may benefit from having some familiarity with programming concepts (e.g., Python or Java), databases (e.g., SQL, JSON, XML), and web technologies (e.g., REST APIs, HTTP methods). Key concepts will be introduced as needed to ensure that all students, regardless of their background, can successfully engage with the course material.

Assessment Methods

- IHE Memory Game (Group Assignment) – 15%
- HL7 CDA and FHIR Exercise (Individual Assignment) – 15%
- Final Exam – 70% (Moodle)

Recommended Reading and Material

Attendance Attendance is mandatory for the sessions in which the Memory Game and the HL7 exercise are conducted, as well as for the final exam. Otherwise, no mandatory attendance is required.

Comments

Introduction to MATLAB for Applications in Life Sciences I (Elective Course)

Degree programme	MME
Semester	1
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

Project-Related Teamwork 1

Degree programme	MME
Semester	1
Course methods	PRJ
Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description

This course focuses on the design, management, and execution of a comprehensive team project within the field of biomedical engineering. Students will gain practical experience by developing detailed project plans, producing documentation and prototypes, writing a scientific paper, and presenting their findings. PRT interacts with other courses that provide students with methods, tools, and practical approaches to address the systemic health challenges related to each project. Through a hands-on, interdisciplinary approach, students will strengthen their teamwork and problem-solving skills in biomedical engineering.

Teaching methods	Group work with support from project supervisors. Self-study and use of guidelines, templates and best practice examples. Presentation of results in oral and written form.
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - Plan a project and distribute tasks among a team (requirements analysis, work breakdown structure, milestone plan) - Work on the project independently - Implement a project for an internal or external client - justify a relevant research question based on the state of the art according to scientific criteria, formulate it in a comprehensible manner and define verifiable criteria for achieving the objective - Independently plan the phases of scientific development or investigation using standard methods, carry them out in a targeted manner, document them in a comprehensible way, and in doing so systematically ensure the traceability, reliability, plausibility and transferability of the findings to comparable problems or contexts
Course contents	<ul style="list-style-type: none"> - Project-specific knowledge and methods of biomedical engineering - Problem analysis, conception, evaluation of solution approaches - Project management and documentation - Scientific work
Prerequisites	Basic technical/medical knowledge and skills in consultation with the project supervisor
Assessment Methods	<ul style="list-style-type: none"> - Mid-semester Evaluation - Project Documents & Management - End-of-Semester Presentation & Extended Abstract
Recommended Reading and Material	- Theme-specific literature
Attendance	Attendance is compulsory.
Comments	Work on this project will be continued in the following semester in the course "Project Related Teamwork 2".

Microprocessor Applications in Medicine

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00

Incoming places	Limited
Course description	This course focuses on practical application of microcontroller basics and programming techniques in a biomedical engineering context. The utilisation of microcontroller peripheral units via the C/C++ programming language (Arduino Libraries, Hardware Abstraction) will be shown.
Teaching methods	Lecture (theoretical content), practical programming examples, programming tasks that are to be solved in distance learning
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - 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	- GPIO, Timer, Interrupts, ADC, serial interfaces (UART etc.)
Prerequisites	basic skills in electronics and programming
Assessment Methods	- programming assignments, final exam (moodle Quiz), see Moodle course
Recommended Reading and Material	
Attendance	obligatory
Comments	

Cellular Electrophysiology and Bioimpedance

Degree programme	MME
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course examines the electrical behavior of cells and tissues in response to electromagnetic fields. It covers the principles, techniques, and potential medical uses of electrophysiology and bioimpedance measurement in diagnostics and therapy.

Teaching methods	Lecture
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - explain the electric behaviour of cells and tissues under the influence of electromagnetic fields - explain applications of electrophysiology and bioimpedance in medicine on examples - point out potentials for innovation using electrophysiology and bioimpedance methodology
Course contents	<ul style="list-style-type: none"> - Electrical engineering basics - Instrumentation and measurement - Electrical - passive and active biological tissue - Data and models - Selected applications
Prerequisites	Basics of:- Physics/Chemistry- Cellular physiology
Assessment Methods	- Final exam
Recommended Reading and Material	<ul style="list-style-type: none"> - S. GRIMNES / O.G. Martinsen, Bioimpedance and Bioelectricity Basics, Academic Press 2000 ISBN: 0-12-3003260-1 - P.J. RITT et al (eds.) Electrical Bioimpedance methodes: Application to Medicine and Biotechnology, Annals of the N.Y. Academy of Siences, Volume 873, 1999,ISBN: 1-57331-190-1 - Biomedical Signals and Sensors I. Linking Physiological Phenomena and Biosignals, ISBN 978-3-642-24842-9 - Biomedical Signals and Sensors II Linking Acoustic and Optic Biosignals and Biomedical Sensors, ISBN 978-3-662-45105-2 - Biomedical Signals and Sensors III Linking Electric Biosignals and Biomedical Sensors, ISBN 978-3-319-74916-7

Attendance

Comments

Company Simulation

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

Course description	<p>The computer aided business game is a strategic management simulation that establishes a link between management theory and business practice. The business game covers all the areas of a corporation and helps the students to identify and to handle the trade-offs which emerge/arise when a company has to be managed. The simulation is set up in a modular way and includes certain degrees/levels of complexity. Products can be sold in up to two markets representing the foreign and the domestic one. The students will promptly experience the effects of their decisions and they will find out how it feels when they have to defend their strategy as representatives of the board during the annual meeting.</p>
Teaching methods	<p>The students take on the task of managing all aspects of a company 4-5 groups (boards of directors) are competing with each other in a common market Decisions are to be taken within the groups (boards) of 3-5 students Through a series of decision taking tasks, the participants learn to apply different methods, how to use information for decision taking and how to handle various factors such as uncertainty and time Owing to its dynamism, the game serves as a realistic example and forces the students to deal with complex situations. This has a long-lasting impact on the students' knowledge</p>
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - to comprehend the past development of the company they have to manage. - to identify the most important interactions between the various decisions to be made when running an enterprise. - to fill out a decision form within a group of 3-5 students. - to identify the threats of uncertainty in the group. - to draw up a simple business plan for the planned future development of their company in M&S area - to make a competition/competitor analyses - to increase the market share by means of influencing the corporate identity and advertising. - to manage the sales staff efficiently - to launch new products accompanied by the proper price policy fitting to the chosen corporate strategy. - to analyze and interpret the results of the the balance-sheet income statement/profit and loss-account cash-flow-statement - to perform a break-even-analysis in a single and a multi product company - to calculate the short-term price floor in case of under utilization

- to calculate staffing requirements by taking into account the fluctuation and the absence time
- to make decisions about personnel competence or qualification measures like training and processoptimisation

Course contents

- M&S: Competition/competitor analysis, corporate identity and advertising decisions, price policy, sales staff management, product life cycle, product launch, product introduction, market entrance in foreign markets, interpreta-tion of market research report as well as contribution margin reports
- R&D: technological and ecological advancement, progress, development, as well as value analysis/engineering
- Procurement: economic order quantity, storage costs, costs of tied capital
- Production: investment and desinvestment of production lines, fixed asset management, reengineering, handling of maintenance costs, investments in environmental equipement
- HR: personnel competence, training, process optimisation, manpower utiliza-tion, absence time and fluctuation/staff turnover
- Finance: balance-sheet, income/profit and loss-statement, cost-accounting, break-even-analysis, cash-flow-statement, long and medium term loans, mul-tidimensional contribution accounting
- VbM: Shareholder value-oriented management, share price, decisions about allocations to revenue reserves and dividend payouts

Prerequisites

Assessment Methods

- 1st attempt: Performance and participation during the course
- Further attempts: Exam

Recommended Reading and Material

- A Participants manual will be delivered to the students via the moodle platform

Attendance

COMPULSORY ATTENDANCE

Comments

Electromagnetic Compatibility

Degree programme	MME
Semester	3
Course methods	ILV
Language	English

ECTS Credits	5.00
Incoming places	Limited

Course description The course is divided into two parts: Part 1 covers the physical fundamentals of Electromagnetic Compatibility (EMC) related to electrical appliances, including regulatory basics for product conformity. Part 2 focuses on the effects of electromagnetic fields (EMF) on the human body, including regulatory basics for limiting personal exposure to EMFs and the influence of EMFs on implants.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

BME for Therapy & Rehabilitation

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

Course description The course provides an overview of key rehabilitation issues across various application areas. It focuses on the integration of biomedical engineering in therapy and rehabilitation, addressing challenges and solutions in designing and applying assistive devices, rehabilitation technologies, and therapeutic interventions. The course emphasizes practical aspects and current trends in the field, preparing students to contribute to advancements in rehabilitation practices.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Scientific Skills

Degree programme MME

Semester 3

Course methods SE

Language English

ECTS Credits 2.00

Incoming places Limited

Course description This course supports tracking the status and progress of the Master's thesis. It incorporates a systemic view by considering stakeholders and the environment and includes completeness checks. Topic-specific scientific methods, such as statistics, electronics, or simulation, are addressed based on students' needs.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Sustainability in Life Sciences

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

Course description This course explores sustainability aspects in hospital planning, medical hardware design, and applications, with a focus on aligning practices with clinical engineering principles. Emphasis is placed on integrating sustainable solutions to meet both environmental and operational demands in the field.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Ethics

Degree programme	MME
Semester	3
Course methods	SE
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description This course provides foundational knowledge of ethics in medicine and engineering, emphasizing the societal impact of ethical decisions in these fields. It fosters awareness of ethical questions, trains decision-making and argumentation skills, and introduces concepts

from business ethics. Topics are explored through case studies and aligned with the Sustainable Development Goals (SDGs).

Teaching methods

Learning outcome

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Image Analysis

Degree programme

MME

Semester

3

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

The course covers fundamental and advanced methods of image processing with a focus on medical imaging technologies, such as CT and PET. Topics include techniques for image acquisition, enhancement, segmentation, and analysis, tailored to the specific requirements of medical applications.

Teaching methods

Learning outcome

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Biosignal Acquisition and Analysis

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

Course description The course offers a comprehensive introduction to the theoretical principles and practical techniques for acquiring and analyzing biosignals. Topics include signal generation, measurement technologies, noise reduction, and data interpretation, with applications in medical and research settings.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Clinical Engineering

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

Course description This course provides an overview of medical equipment in hospitals, focusing on application, requirements, and professional installation, with emphasis on building and hardware integration. It also addresses the planning processes necessary for ensuring compliance with regulatory and operational standards.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Master Thesis Project

Degree programme MME

Semester 3

Course methods IPRJ

Language English

ECTS Credits 5.00

Incoming places Limited

Course description This course guides students through the process of working on their Master's thesis, with a focus on collaborating with external institutions. It ensures a clear connection to Medical Engineering topics and encourages interdisciplinary learning. Students will explore available support services to enhance their entry into careers as researchers and in health care.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Business Modelling

Degree programme MME

Semester 3

Course methods SE

Language English

ECTS Credits 3.00

Incoming places Limited

Course description This course explores the functioning of markets in the healthcare industry and the economic behavior of market participants. It introduces market types, supply-and-demand dynamics, and marketing tools like the "Marketing Mix" to achieve specific goals. Students learn to analyze market processes, develop strategies, and create marketing plans tailored to healthcare products.

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 Analysis of Medical Data

Degree programme MME

Semester 3

Course methods ILV

Language	English
ECTS Credits	3.00
Incoming places	Limited

Course description This course introduces advanced methods in Multivariate Statistics through interactive lectures, examples, and assignments. Topics covered include Factor Analysis, Independent Component Analysis (ICA), Pattern Recognition, Time and Synchronization Problems, Support Vector Machines (SVM), and Nonstationary Problems, all with a focus on biomedical data analysis.

Teaching methods

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

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Innovation and Technology Management (MTM)

Empirical Market Research

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

Course description In this course, students acquire basic knowledge and skills in the field of empirical marketing research.

Teaching methods Self-study, lecture, discussion, exercises, field work in groups (own marketing research project with interviews, survey)

Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - outline objects of cognition and functions of marketing research - plan and manage a marketing research project - distinguish between in-house research and third-party research - distinguish between primary and secondary research; big data, social media data - decide whether to use quantitative or qualitative research techniques - explain measurement concepts and design questionnaires or online-surveys - draw a sample and distinguish sample from census - conduct field work, i.e. run a survey and assure data quality - analyse data, interpret and present marketing research results for decision making
Course contents	<ul style="list-style-type: none"> - marketing research process, functions and uses - defining the research problem, formulating research objectives, research proposal - research design and application: exploratory, descriptive or causal research - in-house research versus third-party research - primary versus secondary data; big data, social media data - research techniques: quantitative versus qualitative; marketing research online-communities - basic modes and types for gathering survey data: personal interviews, telephone interviews, online surveys, focus groups - data measurement (nominal, ordinal, scale measures) and questionnaire development - basic concepts involved with sampling and axioms about sample size - field work and data quality issues - data analysis: qualitative (analysis of topics, grounded theory) and quantitative (descriptive statistics, inference analysis) methods - marketing research report, visuals, oral presentation and discussion of results
Prerequisites	Basic knowledge in scientific work
Assessment Methods	- Moodle-Quiz (30%) + elaboration of a marketing research study (70%)
Recommended Reading and Material	<ul style="list-style-type: none"> - Burns/Veek/Bush: Marketing Research, 9th Global Edition, Pearson Education Ltd. 2020 - Pecher: Marketing Research - Script on Approaches, Research

Concepts, Quantitative and Qualitative Methods as well as Analysis Techniques, V02 of August 2020

Attendance In general, attendance is not mandatory.

Comments

Innovation and Technology Management

Degree programme MTM

Semester 1

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description In this course students acquire basic knowledge and develop competences in the field of Innovation and Technology Management.

Teaching methods self-study, lecture, discussion, group work, case studies, multimedia presentations, final exam

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

- distinguish between different forms of innovation
- know about different innovation strategies
- to establish an innovation-friendly corporate culture
- to apply various project selection methods
- to know about a systematic innovation process from idea finding to market entry

Course contents

- Concept of Innovations and Technologies
- Motivation and Relevance of Innovation and Technology Management
- Sources of Innovation
- Open Innovation
- Types of Innovation
- Innovation Diffusion
- Innovation Strategies
- Innovation Process incl. Stage Gate Process
- Management of the NPD Process
- R&D Project Selection
- Management of Teams in the NPD Process
- Protecting the own Business, e.g. Industrial Property Rights like

Patents, Utility Models or Designs

- Technological S-Curves
- Technology Cycles
- Standards, Modularity and Platforms
- Timing

Prerequisites

Key concepts in business administration.

Assessment Methods

- written test (70%) [at least half of the points must be achieved in order to pass the course]
- teamwork on 'Methods of Innovation and Technology Management' (30%)

Recommended Reading and Material

- Schilling, M. A. (2022). Strategic Management of Technological Innovation. 7th ed., New York: McGraw-Hill Education. [International Edition!]
- additional papers will be provided

Attendance

Attending 75% of the synchronous teaching units is compulsory, regardless of whether they are held in presence or online. Attendance of less than 75% will result in the reduction of one possibility of repeating the final exam.

Comments

Further information and material regarding this course are provided via LMS moodle.

Enterprise Simulation

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

Course description

In this course, students acquire knowledge as well as professional and methodological skills in the field of Innovation and Technology Management. Fundamental organisational skills in Innovation and Technology management are actively applied and reflected upon. The focus of this course is on simulating entrepreneurial decisions in an innovation project, from brainstorming to the development and presentation of a business model and project proposal by working in teams. In addition to the competences of entrepreneurial action and

thinking, experience in teamwork and cooperation in innovation projects and develops presentation skills are also addressed.

Teaching methods

Self-study, discussion, group work, presentations

Learning outcome

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

- identify the challenges of managing innovations in the early phase of the innovation process based on their own (simulated) experience
- recognise and deal with practical challenges of planning, managing and controlling of innovation projects
- recognise the practical challenges of finding and selecting ideas and translate them into project planning
- analyse, apply and actively implement components of a business model innovation
- carry out competitive and market analyses including target group analyses
- develop innovation projects in a team and transfer them into a proposal for a decision maker

Course contents

- Business model innovations
- Management of innovation processes
- Planning, management and control of innovation projects
- Finding and selecting ideas
- Competition and market analyses

Prerequisites

In-depth knowledge of innovation and technology management, in particular the planning, management and control of innovation projects, idea generation and selection, business model innovations, competition and market analyses, target group analyses, project planning methods, industrial property rights/property rights strategies

Assessment Methods

- Presentation of ideas, short presentation and interim presentation (group work)
- Final presentation (group work)
- Final written report (group work)
- Active participation / discussion / feedback

Recommended Reading and Material

Attendance

Due to the teaching/learning methods used, continuous participation is required throughout the entire process, which means that attendance is compulsory throughout.

Comments

If continuous attendance cannot be guaranteed, please contact the lecturer before the start of the course. From the second examination onwards (e.g. in the absence of continuous attendance), the

assessment will be based on a written paper (50%) and an oral defence of the work (50%).

Digital Leadership & New World of Work

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

Course description In this class, we'll talk about and discuss the constant changes in leadership in a world that's moving faster and faster. Using real-life examples from the corporate world, we'll think about how leadership is sometimes understood differently in theory and practice. We'll also touch on artificial intelligence and how it affects leadership.

Teaching methods Inputs Serious games Exercises Students plan and facilitate interactive workshops

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

- Identify and explain the tasks and tools of leadership (e.g. delegation, goal-setting), as well as explain classic leadership models (e.g. leadership continuum, maturity model), weigh up their advantages and disadvantages, and apply them to practical examples.
- describe agile leadership (e.g. in expert organisations, transformation processes) and apply it using examples
- explain the concept of digital leadership (e.g. coaching culture) and apply it in case studies
- outline the most important trends in the labour market and HR management
- Motivate employees and lead virtual teams in an increasingly digitalised working world

Course contents

- Fundamentals of leadership, traditional trait, behavioural and situational theories of leadership
- Systems theory in social systems
- Leadership in a digital context
- Modern leadership concepts (agile leadership, transformational leadership, lateral leadership, etc.)

- Interdisciplinarity and interculturality
- Economic trends: labour market, globalisation, digital transformation
- Specific aspects of leading teams of experts

Prerequisites

None

Assessment Methods

- Facilitation of workshops, serious games, exercises, case studies, written examination

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.

Ecotoxicology & Environmental Management (MUT)

Introduction to Ecotoxicology

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

Course description Effects of chemical substances on humans, the environment and the ecosystem. Risk assessment at all levels (cell, tissue, organs, organism, population, ecosystem).

Teaching methods

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

- estimate possible effects of pollutants on air, soil and water.
- understand possible harmful effects of pollutants on cellular, organ, tissue, organism or population level.
- determine duration of exposure, accumulation, degradation, biomagnification of chemical substances.
- determine potential risks to humans.
- apply mixture toxicity models.
- get to know (eco-) toxicity endpoints and interpret dose-response curves.
- to assess ecotoxicological studies based on their trustworthiness.

Course contents - Effects and fate of pollutants on the environmental compartments, the ecosystem and on humans.

Prerequisites Ecology, environmental chemistry, molecular biology

Assessment Methods - Course immanent, module exam

Recommended Reading and Material

- Fent, K.: Ökotoxikologie, Thieme Verlag
- Sibly, RM., Walker, CH., Hopkin, SP., Peakall, DB.: Principles of Ecotoxicology, Routledge; 4 edition
- Course scripts of the lecturers

Attendance The presence of at least 75% is mandatory. If more than 25% of the units are missed, the first exam start will be lost.

Comments

Bi indicators and Biomarkers

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

Endocrine Substances & Endocrine Disruptors

Degree programme	MUT
Semester	3
Course methods	LAB
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Endocrine substances in the environment
Teaching methods	- lecture- presentation
Learning outcome	After passing this course successfully students are able to ...
Course contents	<ul style="list-style-type: none"> - Endocrine disruptors - definition, properties, substance class, occurrence - Difference between toxic substances and endocrine disruptors - Methods to detect ED-substances in the environment - bioassays
Prerequisites	Ecotoxicology, environmental chemistry
Assessment Methods	- Cooperation of the students, presentation, final examination
Recommended Reading and Material	- Moodle presentations and publications
Attendance	Attendance of at least 75% is compulsory, if more than 25% of the units are missed, the first exam entry is lost
Comments	

Healthcare and Rehabilitation Technology (MGR)

Current Topics in Rehabilitation Engineering

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

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

Wahlfach - Introduction to MATLAB for Applications in Life Sciences I

Degree programme	MGR
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	The course focuses on building a strong foundation of programming in MATLAB. Additionally, the basics of signal processing and the design of graphical user interfaces are covered. At the end of the course, students should be able to use MATLAB confidently for their work and be prepared to deepen their skills in the subsequent course MLS 2. Each lesson includes an interactive introduction of the theory followed by practical assignments ranging in difficulty. Additional

topics can be introduced into the course setup upon request.

Teaching methods

Presentation of lecturers and contribution of students

Learning outcome

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

- Work with various data types in MATLAB
- Use logical operations, arithmetic operations and algorithm control structures
- Write scripts, functions and algorithm flow charts
- Operate with selected I/O file types and visualise data
- Create GUIs

Course contents

- MATLAB data types
- Control structures, logical and arithmetic operators
- Scripts and functions
- Data visualisation
- Script debugging and flow charts
- Signal processing introduction
- Graphical User Interfaces

Prerequisites

Basic programming knowledge. General knowledge from the field of Life Sciences on a Bachelor level.

Assessment Methods

- Contribution during lectures, individual assignments

Recommended Reading and Material

- [1] S. Attaway, MATLAB. A Practical Introduction to Programming and Problem Solving. London: Butterworth-Heinemann, 2013.
- [2] A. B. Biran, What Every Engineer Should Know About Matlab and Simulink. New York: Taylor & Francis Group, 2010.

Attendance

Attendance is optional

Comments

Robotics Engineering (MRE)

Advanced Programming

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

Course description	A modern approach to object oriented programming.
Teaching methods	lectures and webinars - with additional Moodle exercises / examples.
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - program console applications in C++ - perform basic object-oriented programming - apply object-oriented concepts
Course contents	<ul style="list-style-type: none"> - classes and objects - inheritance / polymorphism - templates, interfaces, STL - RAII
Prerequisites	basic knowledge of a structured programming in C (C++)
Assessment Methods	- continuous assesment in course
Recommended Reading and Material	<ul style="list-style-type: none"> - C++: das umfassende Handbuch, Will Torsten T., ISBN-9783836275958 - Schaum's Outline of Programming with C++John Hubbard ISBN-10: 3826609107ISBN-13: 978-3826609107
Attendance	attendance not required but recommended!
Comments	

Advanced Programming for Robots

Degree programme	MRE
Semester	1
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited

Course description	In this lecture, you will learn, how to communicate with a robot by the help of TCP/IP, to be able to control it, send data and receive data.
Teaching methods	Lecture, moodle exercises, hands-on exercises
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - After the LV you will be able to communicate with a robot via network. - After the LV you will be able to launch parallel processes and controll them

	- After the LV you will be able to launch threads and control them
Course contents	- Process handling - Thread processing
Prerequisites	C/C++
Assessment Methods	- Project
Recommended Reading and Material	
Attendance	100%
Comments	

Industrial Engineering & Business (MIB)

International Finance

Degree programme	MIB
Semester	1
Course methods	ILV
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Students will get a broad overview of international finance
Teaching methods	Lecture, case studies, exercises
Learning outcome	After passing this course successfully students are able to ... - analyse financial reports of companies according to managerial standards. - apply common financial ratios and interpret their results. - identify financial risks and know how to apply hedging instruments to manage these risks.
Course contents	- Analysis of financial statements and specific topics - Financial ratios - Risk management
Prerequisites	None required
Assessment Methods	- Company analysis (Group assignment) 30% - Written exam 70%

- Students have to achieve at least a passing level on the written exam and the company analysis respectively to finish the course with an overall positive grade
- Written retake exam 70%
- Company analysis (individual assignment) 30%

Recommended Reading and Material

- Dr. Karl Knezourek, Slides for the lecture, 2022
- Jeff Madura, Roland Fox, International Financial Management, Thomson, 2019
- Graham Friend, Stefan Zehle, Guide to Business Planning, The Economist Newspaper Ltd., latest edition (Ch.I 14)

Attendance

Attendance of the course is mandatory. Students are allowed to miss a maximum of 20% of classes, otherwise they will lose their first exam attempt. Classes start on time. Students are reminded to arrive on time. Students who arrive late for a lecture will receive 0% attendance for that class.

Comments

International Law

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

Course description

This course explains the major European institutions, their structure, tasks and influence and focuses relevant topics of International Economic Law.

Teaching methods

Lector and student presentation, group work, case studies

Learning outcome

- After passing this course successfully students are able to ...
- •list the main bodies of the European Union and list their competencies and impacts on international business
 - •list relevant topics of international business law and explain the impact on international business
 - •explain main differences between international tax, competition and business law compared to national Austrian regulations

Course contents

- •Major European regulations

- •International tax and anti-trust law
- •UN Regulations and INCOTERMS
- •Company and Corporation Law
- •Intellectual Property

Prerequisites none

Assessment Methods

- Participation in class
- Student presentation
- Management Paper
- Exam

Recommended Reading and Material

- Publicly available sources
- My presentations

Attendance online

Comments

Professional Writing Skills

Degree programme MIB

Semester 3

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description In this course you will enhance your ability to write effective texts in English for professional purposes, taking into consideration specific genres, purposes and audiences. In an era of GPT writing tools, this course focuses on the 'human' side of writing, including engaging in collaborative writing tasks, better reflecting the demands of the workplace.

Teaching methods This course takes a flipped-classroom approach whereby students engage with self-learning materials outside of class in preparation for graded writing assignments in class. All writing assignments then receive detailed feedback from expert lecturers.

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

- Analyze and interpret the linguistic design of texts for different target groups and for various purposes in a business context.
- Improvement of competencies for formal English texts in a business

context.

- Write a variety of text forms without technical support (emails, internal offer memos, literature analyses for process improvement).
- Apply writing skills in collaborative writing contexts.

Course contents

- Text analysis
- Formal writing
- Emails and memos
- Text synthesis and recommendation reports

Prerequisites

B2-C1 level English

Assessment Methods

- Continuous assessment of writing skills (in class) (30%)
- Written exam (70%)

Recommended Reading and Material

Attendance

Compulsory as per study programme regulations

Comments

Public Affairs & Lobbying

Degree programme

MIB

Semester

3

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

Corporate public affairs are the "foreign policy" of a company or organisation. Lobbying is the instrument to influence political, legal and socio-political decisions as well as technical regulations in a targeted and strategically planned way. These competences have gained a lot of importance in companies in Austria and the EU. This course provides an insight into what lies behind lobbying and public affairs and how the interaction between business, politics, and society works in practice. It introduces how specific corporate goals can be supported through lobbying and public affairs and how quality and compliance can be ensured.

Teaching methods

The teaching content and correlations are conveyed according to the state of scientific knowledge and deepened by numerous practical

examples. Complex contexts are additionally made comprehensible through video material. The students apply the knowledge acquired in the final thesis and supplement it with their research.

Learning outcome

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

- After successful completion of the course, students can analyse the socio-political environment of a company and improve the competitiveness of the company through concrete, professional measures.

Course contents

Prerequisites

none

Assessment Methods

- Development of a written public affairs and lobbying concept based on a self-selected example.

Recommended Reading and Material

Attendance

80%

Comments

Study Trip abroad 2

Degree programme

MIB

Semester

3

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places

Limited

Quantum Information Laboratory

Degree programme

MIB

Semester

3

Course methods

LAB

Language

English

ECTS Credits

2.00

Incoming places

Limited

Course description

This course complements the course Introduction to Quantum

information by demonstrating and conducting hands-on experiments in which we produce, manipulate and detect qubits.

Teaching methods

Lecture, discussion, independent conduct of experiments

Learning outcome

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

- work in a physics laboratory
- work safely with laser radiation
- take data and evaluate measurement results
- understand concepts like superposition and interference
- understand entanglement and how entangled states can be produced
- know about the polarization of photons and its manipulation
- know and apply protocols to distribute quantum keys

Course contents

- Laser safety
- Lasers and detectors
- Double slit experiment, diffraction at a grating
- Interference and interferometers
- Entanglement and Bell inequality
- Quantum key distribution: BB84 protocol

Prerequisites

Introduction to Quantum information (class 1 and 2)

Assessment Methods

- Laser safety test (10%)
- Lab Reports (90%)

Recommended Reading and Material

- Rainer Müller, Franziska Greinert: Quantentechnologien für Ingenieure (2023)

Attendance

Presence during the classes is obligatory and will be monitored. At least 75% of the classes must be attended in order to pass the course.

Comments

Introduction to Quantum Information

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

Course description	Quantum technologies currently take the decisive leap from foundational research to market readiness. They are one of the key technologies of the 21st century. We study the foundational principles of quantum computing, quantum cryptography and quantum sensing. We put a focus on the state-of-the-art of these technologies as well as chances and risks of their implementation in enterpris and practical aspects such as the certification of quantum technologies.
Teaching methods	<ul style="list-style-type: none"> • learning together: input by the lecturer mixes with contributions by the studends. we aim at a flipped classroom • learning yourself: material for literature research and a moodle-course guide the self-study phases • learning hands-on: this course is complemented by a Lab class in which the students apply the knowledge gained
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - give an overview over the state-of-the art of quantum technologies - explain quantum computing, quantum cryptography and quantum sensing as well as their differences - differentiate between enabling technologies and applications of quantum technologies - explain fundamental mathematical concepts of quantum information and apply them to simple cases - explain fundamental concepts of quantum information: superposition, entanglement, measurement, no cloning, teleportation - describe protocols of quantum key distribution - discuss practical aspects of quantum key distribution - describe physical platforms for quantum computing - apply measures for quantum computers (T1, T2, quantum volume) - understand quantum gates and apply them in simple algorithms - discuss use cases for quantum algorithms - describe quantum sensors and their applications - discuss ethical aspects of quantum technologies - discuss the certification of quantum technologies
Course contents	<ul style="list-style-type: none"> - quantum computing, quantum cryptography and quantum sensing - complex valued linear algebra - foundations of quantum information - BB84-protocol - E91-protcol - free space and fiber based implementation of QKD - hardware for quantum computers - quantum algorithms - quantum sensors

- ethical aspects of quantum technologies
- certification of quantum technologies

Prerequisites none

Assessment Methods

- moodle tests
- student's presentations
- final exam

Recommended Reading and Material

- Müller/Greinert: Quantentechnologien für Ingenieure
- Wong: Introduction to Classical and Quantum Computing

Attendance 75%

Comments

Enterprise Resource Planning

Degree programme MIB

Semester 3

Course methods ILV

Language English

ECTS Credits 3.00

Incoming places Limited

Course description Open discussion to questions around the topic ERP like: - Relevance of ERP for companies - How can requirements be identified - How to start an ERP project - What are the challenges of an ERP evaluation - How you can identify critical success factors of an ERP project

Teaching methods - Lecture- Cases- Exercises
Based on several cases, which are developed by the students in their different roles within an ERP-Team of a "company", the process of selection and implementation is visualized and made comprehensible. The business cases are used as trigger and link to pull information out of the lecturers almost 40 years of ERP-experience! Slide decks, SAT-questions and exam questions are all in English. Course can be held in German upon students request.

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

- name and plan the basic steps of an ERP selection and of an ERP introduction
- identify and name the potentials and risks during an ERP introduction

- name and work with the environment of a company in context with the topic of ERP introduction
- apply the right tools for selection and implementation of ERP-Projects in real life

Course contents

- ERP Basics (definitions, delimitations, market overview, systems architectures)
- No specific ERP system is taught!
- Selection and Implementation of ERP-Systems

Prerequisites

- Business Administration- Project and Business process management

Assessment Methods

- 30% your activity during lectures / SAT results
- 35% of your individual part in the team exercise
- 35% exam
- in each category at least 51% of points must be reached
- <51%=5; 51-64=4; 65-77=3; 78-90=2; >90 = 1

Recommended Reading and Material

- see Moodle.
- Michael Schober Folienskript zur LV Enterprise Resource Planning in Moodle

Attendance

Attendance is compulsory

Comments

This course is supported by moodle. All self assessments and the final exam are moodle based.

Managerial Economics and Operations Research

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

Course description

The lecture covers the topic Waiting Lines, Markov-Chains and Location Models.

Teaching methods

Lecture with an active discussion and independent learning based on the literature provided.

Learning outcome

- After passing this course successfully students are able to ...
- ...model waiting lines and to either calculate or estimate their

	behaviour
	- ...use Markov-Chains to model the ageing of infrastructure
	- ...employ various methods of location planning
Course contents	- Waiting Lines and modelling of waiting line models
	- Markov-Chains
	- Location models and location planning
Prerequisites	Production planning from the previous semester.
Assessment Methods	- Written exam
Recommended Reading and Material	- Eiselt, H.A. & Sandblom, C.-L. (2012): Operations Research – A Model-Based Approach, Springer
Attendance	Attendance is compulsory(subject to modification acc. to current COVID-19 situation as well as regulation posted by the institute management and legislator)
Comments	

Data Science (MDS)

AI Requirements Engineering

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

Statistical Computing

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

Business Development & Innovation

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

Machine Learning 1: Fundamentals

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

Data Engineering & Visualisation

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

Intercultural Leadership & Management

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

Software Engineering Practices in Machine Learning

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

Artificial Intelligence

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

Course description This module introduces computational methods of Artificial Intelligence.

Teaching methods Presentations, Exercises.

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

- give an overview on main directions in Artificial Intelligence, their applications and potentials/limitations
- do logic reasoning using propositional und First-Order-Logic, as well as reasoning under uncertainty, to solve simple tasks with numerical, sequential, hierarchical or geographic data.
- select and implement strategies for searching, games and problem solving, and to evaluate their time and space complexity.
- apply methods based on reenforcement learning for speech recognition
- explain deep learning networks (e.g., convolutional and recurrent neural networks) for pattern recognition problems
- explain Bayesian Belief Networks and apply them for predicitions
- adapt and apply ready-made scripts to carry out complex tasks in the field of Artificial Intelligence

Course contents

- Foundations, directions and applications of AI
- Logic and reasoning under uncertainty
- Searching, Games and Problem Solving

- Neural Networks and Deep Learning
- Reinforcement Learning
- Advanced topics of Statistical & Machine Learning
- Computer Linguistics

Prerequisites Machine Learning Algorithms & Data Structures

Assessment Methods - Übungen
- Abschlussklausur

Recommended Reading and Material - Ertel, W., 2016. Grundkurs Künstliche Intelligenz: Eine praxisorientierte Einführung. 4. Auflage. Springer Vieweg.
- Russel, Norvig, 2015. Artificial Intelligence: A Modern Approach, Pearson.

Attendance Not mandatory, except for the final exam.

Comments

Data Science Ethics

Degree programme MDS

Semester 3

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description Discussion of ethical principles concerning data science

Teaching methods Lectures, Discussions

Learning outcome After passing this course successfully students are able to ...
- discuss ethical issues regarding typical tasks of a data scientist

Course contents - Ethical issues regarding data collection and data manipulation

Prerequisites None

Assessment Methods - Discussion paper
- In-Class participation

Recommended Reading and Material

Attendance Mandatory

Comments

Data Science Law

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

Course description This course focuses on data science-relevant law topics, in particular EU regulations.

Teaching methods Lectures, Cases, Discussion.

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

- give an overview on law topics relevant for data scientists
- identify potential legal risks in the daily work
- advise colleagues regarding data law regulations

Course contents

- General Data Protection Regulation
- Data Act
- Data Governance Act
- AI Act

Prerequisites Principles of Public Law

Assessment Methods

- Exam
- In-Class participation
- Home Work

Recommended Reading and Material

Attendance Mandatory

Comments

Quantum Engineering (MQE)

Quantum Master Project

Degree programme	MQE
Semester	3
Course methods	PRJ

Language	English
ECTS Credits	5.00
Incoming places	Limited

Course description In this course a quantum computing project with domain-specific tasks is implemented as a team under the supervision of experts in the field usually . The projects topics are linked to current research and development problems by our industry partners or the FHTW.

Teaching methods

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

- define project goals
- obtain any resources required to conduct work in a new field
- develop, plan and implement a project based on the latest scientific knowledge
- assure the correctness of results and methods
- interpret the outcomes of experiments, simulations or calculations and put them in context
- present the motivation, results and methods of a project in a way that is appropriate for the target group

Course contents

- Project management
- Documentation
- Presentation
- Technical skills required for the implementation of the project (topic dependent)

Prerequisites Experience in working in teams on projects (QEP, DLS), Quantum Information (QUINF2),

Assessment Methods - Course-immanent course assessment

Recommended Reading and Material - Current research articles, depends on the project

Attendance

Comments

Quantum Optics & Atom Physics Lab

Degree programme	MQE
Semester	3
Course methods	LAB

Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course the students will gain hands-on experience on selected hardware of atomic qubits or ion traps
Teaching methods	
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - work responsibly in a lab environment - design and implement hardware for atomic qubits or ion traps (selected items, eg. laser systems for qubit manipulation, vacuum systems, control electronics, chip design, chip fabrication read out and imaging modules) - document their progress in a lab book - present their progress to colleagues or their supervisors
Course contents	- Design or implementation of hardware for atomic qubits or ion traps (selected items)
Prerequisites	Advanced Optics(QAO), Quantum optics and Atomic Physics (QUO), Quantum engineering practice (QUEP), Electronic control engineering (ELCE), Data modeling lab (QDML)
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Project dependent
Attendance	
Comments	

Quantum Programming Lab II

Degree programme	MQE
Semester	3
Course methods	LAB
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	Students implement quantum algorithms for various applied

problems, such as optimization problems, error correction or circuit optimization

Teaching methods

Learning outcome

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

- write a decoding algorithm that determines the most likely error scenario given an error syndrome
- write a program which simulates a variational quantum algorithm to solve a certain optimization problem
- simulate the effect of noise on a quantum algorithm (or communication protocol) and determine the limit of acceptable noise
- reformulate a given quantum circuit to reduce gate count or circuit depth, validate that the new circuit is equivalent to the original circuit
- write a program to translate a given quantum algorithm into an encoded version in the surface code (output physical instructions to implement corresponding logical gates)

Course contents

- Decoding algorithms for error correction (given an error syndrome),
- Decomposition of arbitrary single-qubit gates
- Reformulating given quantum circuits (reduction of gate count),
- Implementation of VQE or QAOA

Prerequisites

Quantum Computing 1 (QUCP1), Quantum Programming languages (QPL), Quantum information I and II (QUINF1, QUINF2), Software engineering and Design (SWED)

Assessment Methods

- Course-immanent performance assessment

Recommended Reading and Material

- Johnston et al, Programming Quantum Computers

Attendance

Comments

Quantum Sensing & Metrology

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

Course description	This course introduces key techniques in quantum sensing and metrology, such as NMR, atomic clocks, inertial sensing and sensing of electromagnetic fields with quantum systems.
Teaching methods	
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - explain how atomic clocks work - explain the setup and procedure for Doppler free spectroscopy - explain the physical concept of nuclear magnetic resonance (NMR) - explain inertial & gravity sensing with cold atoms - explain the physical principles of quantum gyroscopes - explain how NV-centers can be used as sensors for magnetic fields - explain the Hanbury-Brown-Twiss effect - mathematically and verbally describe constructive and destructive interference and its conditions - distinguish between near-field and far-field interference - distinguish between longitudinal and transverse coherence and explain its relevance for interference - explain the difference between single-beam and two-beam interferometers - explain the difference between single-photon and two-photon interferometers - describe different interferometers and their respective advantages and applications - describe the Elitzur-Vaidman bomb test gedankenexperiment - describe the setup for quantum ghost imaging and explain how it works - explain the standard quantum limit and how to enhance the sensitivity of interferometric measurements by using NOON-states
Course contents	<ul style="list-style-type: none"> - Photonic Interferometry - Matter wave Interferometry - Thermometry - Atomic Clocks - Spectroscopy - Inertial sensing, gyroscopes, gravimetry - Quantum Imaging (Quantum Radar, Ghost Imaging, OCT) - Quantum Microscopy & Heisenberg limit - NMR - Use Cases and applications
Prerequisites	Quantum information 1 (QUINF1), Enabling technologies 1 (QET1)
Assessment Methods	

Recommended Reading and Material

- Simon, Jaeger & Sergienko: Quantum Metrology, Imaging, and Communication
- Degen, Reinhard & Cappellaro: Quantum Sensing (Rev. Mod. Phys.)
- AIP special collection: Quantum Sensing and Metrology: From Industrial Implementations for Market to Their Applications in Fundamental Science

Attendance

Comments

Quantum Computing II

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

Course description In this course students deepen their knowledge of subroutines for quantum algorithms, quantum error correction codes and fault-tolerant quantum computing

Teaching methods

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

- understand the difference between classical and quantum error correction
- understand the stabilizer formulation of quantum error correction codes
- distinguish between correctable and uncorrectable errors
- distinguish between logical gates/qubits and physical gates/qubits
- explain different ways to implement fault-tolerant logical gates
- explain the relation between physical and logical error rates of quantum error correction codes
- discuss the Eastin-Knill Theorem
- explain how Bit-flip and Phase-flip errors can be determined and corrected from the results of Syndrome Measurements
- explain and implement subroutines for quantum algorithms

- (Quantum phase estimation, quantum fourier transform)
- explain Shor's algorithm for factoring in detail
 - describe algorithms for fault-tolerant quantum computing
 - identify quantum algorithms for industry use cases and discuss the possible quantum advantage
 - estimate the scaling of quantum algorithms

Course contents

- Complexity classes
- Phase kickback, amplitude amplification, quantum phase estimation, quantum fourier transform
- Shor's algorithm
- Quantum error correction
- Fault-tolerant quantum computing

Prerequisites

Quantum computing I (QUCP1), Quantum information I and II (QUINF1, QUINF2)

Assessment Methods

- Course-immanent performance assessment

Recommended Reading and Material

- Johnston et al, Programming Quantum Computers
- Nielsen, Chuang: Quantum Computation and Quantum Information

Attendance

Comments

Quantum Optics & Atom Physics

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

Course description

In this course offers an introduction to atomic physics and light-matter interaction as a basis for developing hardware for quantum technologies. It covers the key concepts needed the accompanying lab course.

Teaching methods

Learning outcome

- After passing this course successfully students are able to ...
- describe the energy levels of the electrons in an atom including their fine and hyperfine structure

- derive the connection between life time and linewidth
- explain stimulated emission
- understand Rydberg atoms
- describe how one can model the interaction between a two-level system with quantized light (Jaynes-Cumming (JC) Hamiltonian)
- describe the “classical” limit of the JC Hamiltonian where the light field is a coherent state.
- define the Rabi frequency, define a Rabi oscillation
- describe the mechanical effect of light on atoms (Dipole force, Scattering force, Doppler cooling, Doppler limit) and how they are used for manipulating atomic qubits
- explain how atoms can be cooled using a magneto-optical trap
- explain how stable trapping in a Paul trap works
- discuss the differences of macroscopic and microfabricated ion traps

Course contents

- Light-matter interaction
- Atomic Physics
- Ion traps

Prerequisites

Enabling technologies I and II (QET1, QET2), Advanced Optics(QAO), Quantum information I and II (QUINF1, QUINF2)

Assessment Methods

- Course-immanent performance assessment

Recommended Reading and Material

- Christopher J. Foot: Atomic Physics

Attendance

Comments

Homologation Electronics

Degree programme MQE

Semester 1

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description

This course is dedicated to students who have a degree in computer science. It conveys fundamental concepts electronic engineering

which are prerequisite for the subsequent course program.

Teaching methods

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

Course contents

Prerequisites None

Assessment Methods - Course-immanent performance assessment

Recommended Reading and Material

- Wilfried Weißgerber, Elektrotechnik für Ingenieure 1, Springer Verlag, 2018
- Thomas Harriehausen · Dieter Schwarzenau, Moeller Grundlagen der Elektrotechnik, Springer Verlag, 2019
- M.Marinescu, J.Winter, Grundlagenwissen Elektrotechnik, Springer eBooks, Vieweg+Teubner, 2011
- <https://link-1.springer-1com-1000342cz0905.han.technikum-wien.at/book/10.1007/978-3-658-27840-3>
- <https://link-1.springer-1com-1000342v0075f.han.technikum-wien.at/book/10.1007/978-3-658-21823-2>

Attendance

Comments

Quantum Programming Lab I

Degree programme MQE

Semester 1

Course methods LAB

Language English

ECTS Credits 2.00

Incoming places Limited

Course description The course complements quantum computing I and focuses on quantum algorithms for optimization problems and their implementation using qiskit.

Teaching methods

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

Course contents

Prerequisites -fundamental principles of quantum information (QUINF1)-complex valued linear algebra (MAQE)-quantum gates and fundamental

subroutines for quantum algorithms (QUCO1)

Assessment Methods - Course-immanent performance assessment and final presentation

Recommended Reading and Material - Nielsen & Chuang: Quantum Computation and Quantum Information
- Johnston et al: Programming Quantum Computers

Attendance

Comments

Homologation Computer Science

Degree programme MQE

Semester 1

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description This course is dedicated to students who do not have a degree in computer science. After introducing basic elements of Computer Science (Hardware, Software, networks, development methods and processes) basic programming techniques will be learnt and applied on single-chip-computers.

Teaching methods

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

Course contents

Prerequisites None

Assessment Methods - Course-immanent performance assessment

Recommended Reading and Material - Christian Baun, Operating Systems / Betriebssysteme, DOI: 10.1007/978-3-658-29785-5
- Connor P. Milliken, Python Projects for Beginners – A Ten-Week Bootcamp Approach to Python Programming, DOI: 10.1007/978-1-4842-5355-7
- Sunil Kapil, Clean Python – Elegant Coding in Python, DOI: 10.1007/978-1-4842-4878-2
- Python® Notes for Professionals, <https://books.goalkicker.com/PythonBook/> (free)

Attendance

Comments

Homologation Physics

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

Course description This course is dedicated to students who have a degree in computer science. It conveys fundamental concepts of physics and classical mechanics which are prerequisite for the subsequent course program.

Teaching methods

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

Course contents

Prerequisites None

Assessment Methods - Course-immanent performance assessment

Recommended Reading and Material

- Douglas. Giancoli, Physics for Scientists and Engineers, Global Edition, Pearson
- Geoffrey Brooker: Modern classical optics, Oxford Univ. Press

Attendance

Comments

Quantum Information I

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

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

Quantum Computing I

Degree programme	MQE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	The course introduces the basics of quantum computation and exemplifies the principles in terms of the algorithms by Grover and Shor.
Teaching methods	
Learning outcome	After passing this course successfully students are able to ...
Course contents	
Prerequisites	-fundamental principles of quantum information (QUINF1)-complex valued linear algebra (MAQE)
Assessment Methods	- Course-immanent performance assessment and final presentation

or final exam

Recommended Reading and Material

- Nielsen & Chuang: Quantum Computation and Quantum Information
- Johnston et al: Programming Quantum Computers
- Wong: Introduction to Classical and Quantum Computing
- Aaronson: Quantum Computing since Democritus
- Eleanor G. Rieffel and Wolfgang H. Polak: Quantum Computing, A Gentle Introduction

Attendance

Comments

Enabling Technologies I

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

Course description

In this course students get acquainted with experimental techniques and devices required for manufacturing semiconductor-based devices, cryo-technology and vacuum environments.

Teaching methods

Learning outcome

- After passing this course successfully students are able to ...
- give an overview how different types of vacuum pumps work (roughing pumps, turbo pumps, getter pumps, scroll pumps)
 - be aware of how pressures in rough vacuum, high vacuum and ultra-high vacuum are measured and explain different ways of sealing vacuum chambers
 - discuss how (dry) dilution refrigerators work
 - describe how nanofabrication of the solid-state based qubit processors are made (epitaxial growth, lithographic techniques, evaporation, wet/dry etching & etc.)

Course contents

- Semiconductor qubits
- Semiconductor lasers
- Nanofabrication
- Vacuum Technology

- Cryotechnology

Prerequisites

Basic linear algebra, physics and electronics (MAQE, HOEL, HOPH)

Assessment Methods

- Course-immanent performance assessment and final presentation

Recommended Reading and Material

- Bluhm, Hendrik. "3. Quantum computing, qubits and decoherence". *Electrons in Solids: Mesoscopics, Photonics, Quantum Computing, Correlations, Topology*, Berlin, Boston: De Gruyter, 2019, pp. 125-204. <https://doi.org/10.1515/9783110438321-003>
- P. Krantz, M. Kjaergaard, F. Yan, T. P. Orlando, S. Gustavsson, W. D. Oliver; A quantum engineer's guide to superconducting qubits. *Appl. Phys. Rev.* 1 June 2019; 6 (2): 021318. <https://doi.org/10.1063/1.5089550>
- *Nanoelectronics and Information Technology*, Rainer Waser: *Quantum Computing: Fundamentals and Solid-State Realizations*, DiVincenzo, Ustinov, Schreiber, Vandersypen, WILEYVCH (2012), ISBN: 978-3-527-40927-3
- *Physics of Cryogenics 1st Edition*, 2017, by Bahman Zohuri, ISBN: 978-0-12-814519-7
- Pozar, D. M. (2012). *Microwave Engineering*. Italy: Wiley.

Attendance

Comments

Mathematics for Quantum Engineering

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

Course description

The course content comprises concepts and methods of linear algebra as far as necessary for quantum engineering, the bra-ket-formalism, elements of probability theory, some basics of number theory, and the Fourier transform in the infinite dimensional context.

Teaching methods

Learning outcome

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

Course contents

Prerequisites	None
Assessment Methods	- Course-immanent performance assessment
Recommended Reading and Material	- Jürgen Audretsch: Entangled Systems (WILEY-VCH, 2007), Chapter 1 and Section 12.6
Attendance	
Comments	

Team Performance and Leadership

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

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

Teaching methods

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

Course contents

Prerequisites None

Assessment Methods - Immanent performance assessment (participation in workshops, exercises, case studies, written exam)

Recommended Reading and Material - Current scientific literature and specialist articles
- Presentations and scripts

Attendance

Comments

Information Systems Management (MWI)

Digital Supply Chain Applications

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

Course description Supply chains are an integral part of global business. Therefore, successful supply chain management has become one of the most important success factors for modern companies. However, the high complexity of the supply chain is a major challenge. Recent developments, such as Industry 4.0, have enormous potential to monitor and manage the supply chain even more precisely.

Teaching methods Lecture in attendance Teaching and discussion of practical scenarios during the lectures Short assignments and exercises during the lectures Quizzes/game to evaluate knowledge progress Home exercises to provide practical application of concepts and deeper engagement with concepts Written final exam (open questions & case study)

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

- identify and discuss problems in the context of SCM
- select suitable tools to realize SCM tasks with assistance of tools
- explain the correlation between SCM and Industry 4.0
- know and describe standards, methods and techniques for successful management along the supply chain.

Course contents

- Basics of SCM (actors, goals, scope, bullwhip effect,..)
- SCM standards, methods and techniques (SCOR, SC process analysis, value mapping)
- Tools and instruments for SCM
- Performance measurement in the context of SCM
- Basics of Industry 4.0 and correlations to SCM

Prerequisites no special previous knowledge required

Assessment Methods

- 15% Virtual case study (simulation)
- 25% Homework (theoretical application examples & best practices)

- 60% Final written exam

Recommended Reading and Material - see Moodle course

Attendance Attendance is compulsory

Comments

Systems Engineering

Degree programme MWI

Semester 1

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

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

Teaching methods ILV Student-centered teaching utilizing team project to help students to understand the "Systems Engineering" discipline better.

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

- describe processes, methods, and practices of systems engineering
- use the systems engineering vocabulary/terminology
- recognize systems engineering as a part of project management

- apply requirements analysis techniques for a particular system
- understand the importance of a high quality specification and can create specification
- understand the risk management and cost estimation in systems engineering

Course contents

- Introduction to Systems Engineering
- Systems Engineering Viewpoint
- Complex Systems
- Systems Development Process
- Concept Development Stage
- Systems Engineering Management
- Decision Analysis and Tools
- Systems Modelling with UML

Prerequisites

Software Engineering

Assessment Methods

- Quiz
- Team Project
- Final Presentation

Recommended Reading and Material

- Syllabus based on "Systems Engineering Principles and Practice, 2nd Edition, Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour, Steven M. Biemer"

Attendance

Attendance is mandatory!

Comments

For detail information see Moodle

Knowledge and Document Management

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

Course description

This course starts with a short overview about different knowledge management approaches (as for example the one according to Probst et. al), as well as about the applicable software systems in the different phases/ processes/ blocks of the knowledge management. Afterwards the students learn the different possibilities for the knowledge sharing in companies, while applying different

eLearning systems. Furthermore the targeted application of software systems for the implementation of the document management in companies will be learned by the students.

Teaching methods

Learning outcome

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

- describe different knowledge management approaches
- apply selected eLearning systems for the implementation of eLearning scenarios for the dissemination of knowledge
- apply different software systems for the implementation of the document management in companies

Course contents

- Overview about knowledge management approaches
- Overview about software systems for the knowledge and document management
- eLearning systems for the dissemination of knowledge in companies
- Software systems for the implementation of document management in companies

Prerequisites

None

Assessment Methods

- Course immanent assessment method
- End exam

Recommended Reading and Material

- see Moodle

Attendance

Comments

IT-Governance (ITIL, Cobit)

Degree programme

MWI

Semester

3

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

Understanding IT organizations as customer-driven service organizations, this course puts the focus on all aspects necessary to provide efficient and effective IT services. And while technical assets

are still central to IT service organizations, the focus shifts to non-tangible assets like knowledge, capabilities and processes. The course explains best practices and international standards in IT management/governance like Cobit and ITIL.

Teaching methods	Lecturer presentations Student recaps In-course exercises & case studies Group work
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - give an overview of the relevant standards and frameworks as well as discuss them regarding their use for an organization - name and apply the parts of ITIL4 - give an overview of COBIT2019 and its key principles - give an overview of the aspects of COBIT implementation and COBIT assessment
Course contents	<ul style="list-style-type: none"> - IT process management - IT service management - IT governance - Cobit - ITIL
Prerequisites	Foundations of IT management Foundations of process management
Assessment Methods	<ul style="list-style-type: none"> - Assessment of group work and final exam - Assessment of in-course contribution
Recommended Reading and Material	- see moodle course
Attendance	attendance required
Comments	

Renewable Energies (MEE)

Investment and Financing

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

Course description	In this sub-module, students acquire basic knowledge and skills in the field of finance.
Teaching methods	Flipped Classroom
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - At the end of the course the students are able to define the terms "investment" and "financing", to outline a typical investment process, to check investment projects by means of static or dynamic methods for their advantageousness, to determine the optimal useful life of an investment, to model investment program decisions in the form of linear systems of equations, to consider the uncertainty of future cash flows in capital budgeting, distinguish between equity and debt capital as well as between internal and external financing, provide a structured overview of short, medium and long-term debt financing instruments, prepare a financial plan for short-term liquidity management, outline the mode of operation and limitations of the leverage effect, model investment and financing calculations in Microsoft Excel.
Course contents	<ul style="list-style-type: none"> - Investment concept - Investment process - Key figures for asset analysis - Static investment calculation methods - Dynamic investment calculation methods - Investment calculation with Excel - Optimal service life - Taxes in the investment calculation - Utility analysis - Investment calculation with uncertainty and risk - Investment Program Planning - Financing term - Equity vs. debt capital - Internal financing - Working capital management - External financing - Ordinary capital increase and subscription right - Stock exchange - Leverage effect
Prerequisites	Fundamentals of business administration (1st semester)
Assessment Methods	- final exam: 100%
Recommended Reading and Material	- Wala, Haslehner, Kreidl: Investitionsrechnung und betriebliche Finanzierung, LexisNexis

- Wala, Baumüller: Klausurtraining Investitionsrechnung, BookBoon

Attendance

See examinations regulations

Comments

Details see moodle course

Control Technology

Degree programme

MEE

Semester

1

Course methods

ILV

Language

English

ECTS Credits

5.00

Incoming places

Limited

Course description

Development of control technologies for the automation of buildings, industrial processes and electrical grids. Special attention is paid to the requirements regarding energy saving, the use of renewable energies, the digitalization of electrical grids and the consideration of cyber security.

Teaching methods

Lecture, discussion, seminar work and practical exercises

Learning outcome

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

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

Course contents

- Basics of the data transfer including error detection and interfaces between different bus-systems and the importance of the ISO/OSI-model
- Requirements concerning the structure of a control-system including the building automation & the piping and instrumentation diagrams
- Requirements concerning the Industrial Ethernet and the use of standardized protocols
- Structure of a process-close control station including sensors and

actors for binary and analogue data

- Getting to know the standardized programming languages

according to IEC 61131-3

- Advantages and disadvantages of different bus-structures as star, ring and line topology

- Advantages and disadvantages of different bus medias as cable, optical fiber and wireless based on European standards

- Estimation of the probability of failure for different structures of the supervisory control and data acquisition system

- Origins of electromagnetic interferences and possible corrective actions and how to avoid electromagnetic interference during industrial data transmission

- Method of operation and application of smart meter in smart grids

Prerequisites

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

Assessment Methods

- Written exam
- Seminar work
- Exercises

Recommended Reading and Material

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

Attendance

75% Attendance is compulsory

Comments

Innovation and Technology Management

Degree programme MEE

Semester 1

Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	In this course, students acquire basic knowledge and skills in the field of innovation and technology management.
Teaching methods	Self-study, lecture, discussion, group work, case studies, multimedia presentations, reflection, critical thinking, flipped classroom
Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - understand the basics of innovation management and the tasks of innovation managers - understand the importance of innovation for corporate success - create the organizational and personnel requirements for an innovation-friendly corporate culture - know a systematic innovation process from idea generation to market launch - know the advantages of different (open) innovation methods - gain an overview of current developments and place them in context - understand the basics of technology management
Course contents	<ul style="list-style-type: none"> - Theory on innovation - Innovation culture and change management - Innovation management methods - Idea management - Innovation strategy & process - Technology management in the context of research and innovation - Current real world examples
Prerequisites	none
Assessment Methods	- written reflection
Recommended Reading and Material	- as in Moodle
Attendance	
Comments	Detailed information and additional teaching materials are made available via the Moodle learning platform

Energy Storage Technologies

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	Basics of energy storages: The lectures have the goal to give the students a basic understanding about the energy storage systems. The lectures describe the main laws of the energy storage systems and their use for designing simple application.
Teaching methods	Integrated lectures
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - explain the design and operation of different energy storages - choose energy storages for specific applications
Course contents	<ul style="list-style-type: none"> - Structure and functionality of the different storage systems (Electrical, thermal, P2X, component activation, etc.) - Identify the requirements for each application - Safety - Storage selection and sizing - Storage monitoring and balancing - Test procedure - Modeling and parameter identification
Prerequisites	Construction engineering, electrical and thermal energy engineering at bachelor level
Assessment Methods	- Exam
Recommended Reading and Material	<ul style="list-style-type: none"> - Jossen A. und Weydanz W.: Moderne Akkumulatoren richtig einsetzen, Inge Richardt Verlag, 2019 - Sterner M. und Stadler I.: Energiespeicher – Bedarf, Technologien, Integration, Springer Vieweg, 2014 - Kurzweil P. und Dietlmeier O. K.: Elektrochemische Speicher, Springer Vieweg, 2015 - Bauer S.: AkkuWelt, Vogel Business Media, 2017
Attendance	
Comments	

Introduction to Modelling and Simulation

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

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

Teaching methods Project work with Q&A and presentation of the project progress in face-to-face and distance learning for the independent creation of the models, implementation of the simulation and documentation in the form of a project report

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

- To model and simulate more complex energy systems
- To produce, test and use the necessary code
- Perform optimizations for an energy system
- Combine several individual models to form a larger overall model
- To assess and name the applicability, strengths and challenges of typical energy system models
- Explain the code involved and find and fix bugs in it

Course contents

- Students choose a project of a typical energy system:
 - - Building energy systems (PV simulation, Building thermal model)
 - - Positive energy Districts (Integrated models, District energy networks)
 - - Energy community systems (PV, Emobility, Storage)

- - Building Integrated PV systems (Electrotechnical Systems)

Prerequisites

MEE1-4 Introduction to Modelling and Simulation

Assessment Methods

- 30% intermediate presentation of the exercises (teamwork) halfway through the course
 - 70% final presentation of the exercise results at the end of the course (open book) with an integrated examination discussion on understanding and theory. The students present their executable model and answer questions about its function and structure. The focus of the performance assesment is on the handling of the model. Students should be able to explain how the modeling and simulation can be implemented

Recommended Reading and Material

- Nollau, R., 2009. Modellierung und Simulation technischer Systeme: Eine praxisnahe Einführung. Springer-Verlag, Berlin Heidelberg. <https://doi.org/10.1007/978-3-540-89121-5>
 - Crastan, V., 2004. Modellierung und Simulation, in: Crastan, V. (Ed.), Elektrische Energieversorgung 2: Energie- und Elektrizitätswirtschaft, Kraftwerktechnik, alternative Stromerzeugung, Dynamik, Regelung und Stabilität, Betriebsplanung und -führung. Springer, Berlin, Heidelberg, pp. 367–412. https://doi.org/10.1007/978-3-662-06958-5_10

Attendance

Mix of classroom and distance learning (50-50)

Comments

Specialization Focus Definition and Scientific Methods

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

Course description

The course provides an introduction to the principles of scientific work, focusing on the structural design and implementation of scientific projects. Students engage in the analysis of interdisciplinary research projects to examine their structures, holistic approaches, and the interconnections between various disciplines. Particular emphasis is placed on the autonomy to define individual priorities,

enabling students to decide which aspects or disciplinary perspectives to emphasize in their analysis. The objective is to foster interconnected thinking and critically evaluate the complexity and value of interdisciplinary approaches.

Teaching methods

Learning outcome

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

- understand and be able to reproduce the structure, implementation and choice of methods of scientific work/publications
- understand holistic, interdisciplinary evaluation systems and be able to think in a networked way and reproduce them conceptually
- understand the results, be able to classify them and interpret them in a wider context
- write up the results of the project work, taking into account the formal (e.g. linguistic implementation,...) and content-related requirements (e.g. quality of their own contribution,...)
- apply methods from different disciplines to create holistic concepts

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Ethics in Technology

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

Course description Ecological and societal aspects of (energy) technology application is covered and deepened through two courses Ethics in technology

Teaching methods Blended learning – short interactive theoretical inputs, deepening exercises in small groups, discussions, presentations

Learning outcome	After passing this course successfully students are able to ... - to link the acquired knowledge on ethical basics of technology development and application with the area of renewable energy
Course contents	- Basics, dimensions of responsibility etc, different ethical concepts, application of these notions within the context of sociotechnical systems
Prerequisites	none
Assessment Methods	- E-learning tasks. presentations, test
Recommended Reading and Material	
Attendance	75 %
Comments	

Ecology and Society

Degree programme	MEE
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	Students gain insights into current ecological and social issues. They address areas of tension such as climate change and energy poverty. Creative means of communication are needed to transfer scientific findings to the general public. The further development of STEM (Science, Technology, Engineering, Mathematics) into STEAM (Science, Technology, Engineering, Arts, Mathematics) aims to tackle problems with innovation, creative and critical thinking, cooperation and effective communication. In this course, students will engage with the medium of art within a scientific context. Following an introductory session at the University of Applied Arts Vienna, group-based art projects will be developed that reflect the themes explored throughout the course.
Teaching methods	Lectures, Excursion, Group project
Learning outcome	After passing this course successfully students are able to ... - ... explain the basis of ecology, biodiversity and climate change.

- ... critically examine the connections between historical power structures, social inequality, and their implications in the wake of climatic changes.
- ... understand and assess the complex interdependencies between environment and society.
- ... explore and communicate social and ecological issues in the form of an art project.
- ... recognise different art forms and use them in an appropriate context.

Course contents

- Lectures on ecology and society
- Introduction to artistic methods (Excursion to University of Applied Arts Vienna)
- Group work on an art project
- Final presentation of the group art projects at an exhibition

Prerequisites

none

Assessment Methods

- Art Project (50 %)
- Art Report (50 %)

Recommended Reading and Material

Attendance

75 % - Participation in the excursion is mandatory

Comments

Life Cycle Analysis

Degree programme

MEE

Semester

3

Course methods

PRJ

Language

English

ECTS Credits

3.00

Incoming places

Limited

Course description

Life Cycle Analysis (LCA) as a method of process assessment: After a general introduction into LCA and the use of the LCA software openLCA and the ecoinvent database, the students perform a software-supported LCA.

Teaching methods

Lectures, interactive phases, semester work in small groups, presentations

Learning outcome	<p>After passing this course successfully students are able to ...</p> <ul style="list-style-type: none"> - to carry out and adequately interpret life cycle analyzes for products, projects and services using suitable methods, databases and software solutions. - to apply life cycle thinking and a systemic approach to assessment - to apply software and database handling (openLCA, ecoinvent). - to develop methods to link environmental and economic assessment tools
Course contents	<ul style="list-style-type: none"> - Introduction to LCA - Introduction to LCA software openLCA and use of the ecoinvent database - Performing of an LCA
Prerequisites	Basic knowlegde of material and energy flows, basics in ecology
Assessment Methods	- Project reports and presentation of results
Recommended Reading and Material	<ul style="list-style-type: none"> - Klöpffer, W., Grahl, B., 2009, Life Cycle Assessment (LCA). A Guide to Best Practice. Wiley-VCH, Weinheim - Various tutorials by GreenDelta (openLCA) and ecoinvent
Attendance	75 % attendance
Comments	

Energy and Environmental Law

Degree programme	MEE
Semester	3
Course methods	ILV
Language	English
ECTS Credits	5.00
Incoming places	Limited
Course description	<p>Introduction and overview in important aspects of Austrian and European energy law. Content of European and national legislation will be analysed and application of law will be discussed. Focus is on legal acts in the field of renewable energy, energy efficiency, electricity and gas, environmental impact assessment and climate change.</p>
Teaching methods	<p>The content will be developed in the lectures and deepened as part of distance learning. The method for economic calculation is trained</p>

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 ...

- to analyze legal texts (laws, regulations, notices, guidelines).
- to describe the essential provisions of relevant legal acts in the areas of renewable energy, energy efficiency, climate protection, EIA and electricity and gas industry law
- to show the application of the aforementioned legal acts using application examples.
- to take into account knowledge of the obligations and rights of the respective “other” positions (applicant, authority) during the approval processes
- to link knowledge of legal acts with the content of other courses (e.g. ecology, social contexts...)

Course contents

- European Directives
- Electricity and Gas Act in Austria
- Green Electricity Law
- Energy Subsidies and Taxes
- Environmental Impact Assessment
- Emissiontrading

Prerequisites

Assessment Methods

- course immanent assessment method
- end exam

Recommended Reading and Material

- Raschauer Bernhard: Handbuch Energierecht, 2006, Springer, Wien New York, S. 254
- Achleitner Norbert: Österreichisches und Europäisches Energierecht, Einführung und Überblick, 2009, Verlag der Technischen Universität Graz, S. 218
- EU-Recht: www.eur-lex.euro
- Recht Österreich: www.ris.bka.gv.at

Attendance

75%

Comments

Digital Leadership

Degree programme

MEE

Semester

3

Course methods

UE

Language	English
ECTS Credits	5.00
Incoming places	Limited

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

Teaching methods

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

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

Course contents

- Fundamentals of leadership, traditional traits, behavioural and situational theories of leadership
- Systems theory in social systems
- Leadership in a digital context
- Modern leadership concepts (agile leadership, transformational leadership, servant leadership and other such theories)
- Interdisciplinarity and interculturality
- Trends in the economy: the labour market, globalisation, digital

transformation and Industry 4.0
 - The specifics of leading teams of experts

Prerequisites

Assessment Methods - Participation in workshops, exercises, case studies, written exam

Recommended Reading and Material

- Berninger-Schäfer, E. (2019): Digital Leadership; Die Digitalisierung der Führung, managerSeminare Verlags GmbH
- Franken, S. (2019): Verhaltensorientierte Führung; Handeln, Lernen und Ethik im Unternehmen, 4. Auflage, Gabler
- Gasteiger, R., Kaschube, J., Rathjen, Ph. (2016): Interkulturelle Führung in Organisationen, Menschen in globalen Kontexten effektiv führen, essentials Springer Gabal
- Greßer, K., Freisler, R. (2020): Ready for Transformation; Neue Arbeitswelt, digital und agil..., managerSeminare Verlags GmbH
- 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

- Participation in workshops, exercises, case studies, written exam

Attendance none

Comments none

Master Project

Degree programme MEE

Semester 3

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 specialized project. 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 ...

- understand, develop, model and simulate/optimize/calculate holistic, interdisciplinary systems or selected aspects
- understand and classify the results and interpret them in a wider context
- carry out an interdisciplinary evaluation of the results (e.g. ecological, sociological, energy-related, economic, ...)
- 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
- think about aspects of technology with economic, socio-economic and legal implications in a networked way

Course contents

- Processing of a subject-specific task, according to the subject area and the specialization
- 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

Assessment Methods

- Course-immanent performance assessment
- final report

Recommended Reading and Material

Attendance

Comments

Current Topics in Renewable Energy Supply

Degree programme	MEE
Semester	3
Course methods	PRJ
Language	English

ECTS Credits	5.00
Incoming places	Limited
Course description	Based on the energy efficiency and supply targets of the EU and its member states, cities, municipalities and companies, individual aspects of future energy systems, holistic considerations and socio-political strategies with regard to the 2030/2050 climate targets are to be worked on using a concrete case study. On the basis of an introduction to current research projects and directions, a topic is to be deepened in the form of a project work and a scaling of the results is to be undertaken at a higher level.
Teaching methods	Specific inputs on the individual topics and themes, independent group work with methods adapted to the respective issue
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - Identify important sub-aspects of the energy system and scale them up to national/EU level. - Evaluate ecological, economic and societal impacts Develop solution strategies and recommendations. - Include citizens and users in these strategies. - Keep it to the most important things - bring together clear layout, use illustrations correctly. - Understand the process and results and communicate them clearly.
Course contents	- Networked application of teaching content from previous semesters and transfer to larger energy systems as well as their holistic evaluation
Prerequisites	Technical, economic and ecological previous knowledge, especially building on the following modules 1st semester "Energy, Environment, Society" and 2nd semester "Energy Systems", "Assessment Procedures".
Assessment Methods	- Assessment Presentation of the results and preparation of a project folder (max. 4 pages)
Recommended Reading and Material	- Aktuelle Energieeffizienz und- versorgungszielen der EU und deren einzelner Länder, Städte, Gemeinden und Betriebe - z.B. #Mission2030 https://mk0positionencfuw60h.kinstacdn.com/wp-content/uploads/2020/03/mission2030.pdf - Europäischer Rahmen für die Klima- und Energiepolitik bis 2030 und 2050 - Für die Projektarbeit: Wird je nach gewähltem Projekt in der LV zur

Verfügung gestellt

Attendance

Student attendance is required on all dates.

Comments

Supply and Demand Side Management

Degree programme MEE

Semester 3

Course methods ILV

Language English

ECTS Credits 5.00

Incoming places Limited

Course description

The aim of the lecture ‘Supply and Demand Side Management’ is to teach innovative concepts for the integration of renewable, decentralised electricity generation and flexible demand in the Austrian electricity market. As a basis for this, the fundamentals of the function and organisation of the liberalised electricity market are developed.

Teaching methods

Keynote speeches, short presentations, project work in small groups

Learning outcome

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

- describe the technical, economic and organizational principles of the function of the Austrian electricity market
- develop possible applications for virtual power plants
- describe demand response measures and analyze the prerequisites for their implementation
- describe energy efficiency potentials in the electricity sector and measures for their realization
- locate new concepts (e.g. energy communities) in the context of energy supply

Course contents

- potentials for Sector coupling
- Business models for flexibilities
- Short term forecasts of electricity production and consumption
- Virtual power plants: concepts and applications
- Demand Side Management as a flexibility
- potentials for energy efficiency in the electricity sector
- Demand Side Management in the building sector
- company scale energy management

- energy management for households

Prerequisites Digital Systems Energy Economics

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Process Optimization

Degree programme MEE

Semester 3

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description After an introduction to the methods of process optimization (5S, Kaizen), industrial processes are optimized in small groups (focus: energy processes)

Teaching methods Lectures, interactive phases, semester work in small groups, presentations

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

- to analyze industrial processes in the areas of production, energy generation, storage and transmission, and to identify and implement potentials for optimization
- to describe how the optimization proposed is relevant concerning the entire energy system putting special emphasis on the energy and resource consumption caused by the processes.

Course contents

- Introduction to process management and process optimization
- Selected methods and tools for process acquisition, -analysis and -optimization
- Overview of various applications of industrial processes
- Performing of a process optimization with a focus on energy applications

Prerequisites project management, process management

Assessment Methods	- Project report, presentation and exam
Recommended Reading and Material	- Hirzel, M., Kühn, F., Gaida, I., 2008, Prozessmanagement in der Praxis, Gabler, Wiesbaden
Attendance	75 % attendance
Comments	

Sports Technology (MST)

Biomechanical Multibody Simulation

Degree programme	MST
Semester	1
Course methods	UE
Language	English
ECTS Credits	2.00
Incoming places	Limited
Course description	In this course, students learn to use biomechanical or musculoskeletal simulation software to analyse and predict muscle and joint forces that occur in human movement and sport. They will gain basic knowledge of AnyBody and OpenSim software.
Teaching methods	Exercises
Learning outcome	After passing this course successfully students are able to ... <ul style="list-style-type: none"> - develop simple models based on anthropometric data using multibody-simulation software - conduct biomechanical analyses using multibody-simulation software - name advantages and disadvantages of biomechanical multibody-simulation software and discuss their sensible use depending on specific research questions
Course contents	<ul style="list-style-type: none"> - Current biomechanical multi-body simulation software (e.g. Anybody, OpenSim) - Determination and visualisation of internal forces using biomechanical multi-body simulation
Prerequisites	grundlegende Mechanikkenntnisse, grundlegende Kenntnisse der Anatomie und Physiologie

Assessment Methods	- Projektabgabe
Recommended Reading and Material	<ul style="list-style-type: none"> - Winter, D.A., 2005, Biomechanics and motor control of human movement, Hoboken - Bartlett, R., Introduction to Sports Biomechanics Analysing Human Movement Patterns, Second Edition, Routledge - AnyBody Tutorials, https://anyscript.org/tutorials - Open Sim Tutorials, https://simtk-confluence.stanford.edu/display/OpenSim/Examples+and+Tutorials
Attendance	mandatory attendance, min. 75%, consequences: see Moodle course
Comments	

Materials Science in Sports Technology

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

Course description The Course Materials Science in Sports Technology teaches the basics of materials (metals and polymers); these include their structure and their properties, as well as their testing (part 1: Basics). Building on the basics, the understanding of materials is extended and deepened (part 2: Consolidation). In detail, the two parts include

Part 1 Basics Materials Structures Materials Testing Metals & Alloys (Steel; Al, Mg, Ti & Alloys) Polymers

Part 2 Consolidation Nanocrystalline Metals & Alloys Amorphous Materials Materials Failure Creep & Chemical Degradation of Polymers Additive Manufacturing & 3D Printing

Teaching methods Integrative course

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

- select and develop appropriate test methods for materials and sports equipment.
- select suitable materials for sports equipment.
- use strengthening mechanisms in metals for applications.
- to assess new developments in the field of materials.

Course contents	<ul style="list-style-type: none"> - Materials testing and special test methods - Polymers - Steel - Light metals (Al, Mg, Ti) - Strengthening mechanisms for metals - Creep of metals and plastics - Nanocrystalline materials & alloys - Rheology - Wood - Additive manufacturing and 3D printing
Prerequisites	none
Assessment Methods	- Two partial tests: Part 1 multiple choice + free text, Part 2 written, free text
Recommended Reading and Material	
Attendance	not mandatory
Comments	The exam for part 1 ('intermediate exam') must be taken by all students, also by those which have successfully passed the exams of the respective BHF/BST courses of TECHNIKUM WIEN. Please note that the slides have been updated with respect to any of the previous BHF/BST or MST courses.

Mechanical Calculations in Sports Technology

Degree programme	MST
Semester	1
Course methods	ILV
Language	English
ECTS Credits	3.00
Incoming places	Limited
Course description	After discussing the theoretical fundamentals of physics and mechanics, examples from the broad field of sport are discussed, analysed and calculated based on the principles of technical mechanics. Examples from the fields of sports technology / sports engineering are used to convey the content.
Teaching methods	Teaching the theoretical basics. Based on this, calculations are carried out. Methods from technical mechanics are applied to

concrete examples from sport.

Learning outcome

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

- Solve problems from statics, apply strength of materials and dynamics to examples from the subject area.
- Master the basics of selected sports equipment and determine their mass moment of inertia.

Course contents

- Mass moment of inertia, Support forces, internal forces and stresses in beams
- Plane kinematics
- Basics of impact calculation

Prerequisites

Basics in statics, strength of materials & dynamics.

Assessment Methods

- Overall grade results from preliminary examinations and block examinations

Recommended Reading and Material

- Will be provided as part of the course.

Attendance

not mandatory

Comments

Applied Biomechanics

Degree programme

MST

Semester

1

Course methods

ILV

Language

English

ECTS Credits

3.00

Incoming places

Limited

Course description

In addition to the basics of biomechanics and some examples from sports biomechanics, this course also covers the basics of simulating human movements and the resulting calculation of muscle and joint forces. The topics mainly include the biomechanics of cycling and running, as well as technical and biomechanical backgrounds in Paralympic sports.

Teaching methods

Learning outcome

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

- to name and discuss the internal and external forces acting on athletes during sporting activity.

- Calculate the loads resulting from the external forces acting on the athlete
- To quasi-statically calculate the centre of gravity of athletes during sporting activity using different anthropometric models
- Describe phases, ground reaction forces and centre of pressure progression of different running styles
- Describe the essential elements of the mechanics and biomechanics of cycling and perform pedalling force calculations
- discuss the advantages and disadvantages of different methods for recording human movement and describe the technical background to these methods
- reproduce and discuss the most important aspects of biomechanics in Paralympic sports, especially prosthetic sprinting and wheelchair driving

Course contents

- calculation of Center of Gravity
- anthropometric models
- basic biomechanics of different movements and sports
- Internal and external forces
- torque
- inertia
- Energy, work, impulse
- Calculate muscle forces and joint forces

Prerequisites

Basics of Mechanics Basics of Material Sciences Basics of Anatomy and Physiology Basics in Informatics

Assessment Methods

- exam
- different exercises

Recommended Reading and Material

Attendance

not mandatory

Comments

Rapid Prototyping Project

Degree programme	MST
Semester	3
Course methods	PRJ
Language	English
ECTS Credits	2.00

Incoming places Limited

Aerodynamics

Degree programme MST

Semester 3

Course methods ILV

Language English

ECTS Credits 3.00

Incoming places Limited

Course description The course aims to develop an understanding of the aerodynamical and hydrodynamical properties of sports equipment and to develop the ability to change those by dedicated construction measures. To this end the basics of hydrodynamics are first introduced which are then applied to specific examples occurring in the development of sports equipment.

Teaching methods

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

- describe the consequences of the shape of sports equipment on its aerodynamical and/or hydrodynamical behaviour.
- purposely influence the aerodynamical and/or hydrodynamical behaviour of sports equipment by measures concerning its design.
- perform basic hydrodynamical calculations.
- describe motions along stream filaments and streamlines.
- apply CFD-methods in the modelling of the aerodynamical and/or hydrodynamical behaviour of sports equipment to better understand the latter and to modify it by design changes.

Course contents

- hydrostatics
- hydrodynamical basics
- motions along stream filaments and streamlines
- viscous flows
- flows with and without vorticity
- compressible flows
- inviscid flows
- CFD - Computational Fluid Dynamics

Prerequisites

- Foundations of technical, natural, and applied sciences-
Mathematical foundations

Assessment Methods - Final exam (oral presentation of work done in groups) and written assignment

Recommended Reading and Material

- Laurien, E., Oertel, H., 2013, Numerische Strömungsmechanik, Springer Vieweg
- Oertel, H., Böhle, M., Reviol, T., 2015, Strömungsmechanik für Ingenieure und Naturwissenschaftler, Springer Vieweg
- Hucho, W-H., 2012, Aerodynamik der stumpfen Körper, Springer Vieweg

Attendance Optional, but especially recommended for the PC lab hours and also because of the written assignment and group work which are assigned during term.

Comments

Bionics

Degree programme MST

Semester 3

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description Recognize natural systems as model for the development of innovative applications in all areas of modern life. Using knowledge based on fundamental understanding of biological systems can enable materials, systems and applications with innovative properties that outperform traditional solutions significantly.

Teaching methods interactive lectures. Questions and participation is asked for!

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

- - use natural sciences to investigate and understand the fundamental mode of operation of biological systems
- - discuss the use of bionic for developments in sports technology
- - create knowledge on the basis of biological systems and transfer it to the development of technical applications

Course contents

- - definition and discussion of the term "Bionics"
- - functions of biological surfaces
- - possible applications of bionics in the area of Sports Technology

Prerequisites	no special prerequisites necessary
Assessment Methods	- written examination
Recommended Reading and Material	- slides will be shared
Attendance	
Comments	

LCA and Green Design in Sports Technology

Degree programme	MST
Semester	3
Course methods	UE
Language	English
ECTS Credits	3.00
Incoming places	Limited

Statistics and Qualitymanagement

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

Sports Practice Measurement Week - Winter

Degree programme	MST
Semester	3
Course methods	PRJ
Language	English
ECTS Credits	3.00
Incoming places	Limited

Rapid Prototyping

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

Tissue Engineering and Regenerative Medicine (MTE)

Biomaterials in Tissue Engineering

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

Course description The students obtain knowledge on medical applications of biomaterials as well as about basic concepts regarding design and mechanical properties of selected natural and synthetic biomaterials. Topics from current research projects of the UAS Tech are explained and discussed.

Teaching methods - Lecture/Presentation - Discussions

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

- describe the basic techniques to manufacture scaffolds from raw biomaterials and explain the different prerequisites for the biomaterials.
- explain design concepts found in nature in the biomaterials field.
- differentiate biomaterials regarding their properties and assess their usage in a specific application.
- describe the most common techniques to test cell biocompatibility of biomaterials and apply them on different biomaterials.
- correlate the molecular structure of a biomaterial with its properties as a biomaterial.

Course contents

- Elements of biomaterials
- Self-assembly and growth

- Mechanical concepts in biomaterials
- Different protein fibers: collagen, silk, keratin
- Methods for the determination of biocompatibility
- Soft tissue - skin
- Cartilage
- Biological composite materials e.g. fibers
- Biocompatible materials, polymers and metals bioceramics e.g. teeth
- Hierarchical design bone
- Wound care und suture materials
- Vascular implants
- Biomimetic and bio-inspired materials
- Polysaccharidic Biomaterials

Prerequisites Basics of chemistry and protein chemistry

Assessment Methods - Final exam

Recommended Reading and Material

- Gordana Vunjak-Novakovic, R. Ian Freshney (2006): Culture of Cells for Tissue Engineering, Wiley
- Ulrich Meyer, Thomas Meyer, Jörg Handschel, Hans Peter Wiesmann (2009): Fundamentals of Tissue Engineering and Regenerative Medicine, Springer
- Relevant publications will be provided via moodle

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

Stem Cell Basics

Degree programme MTE

Semester 1

Course methods ILV

Language English

ECTS Credits 2.00

Incoming places Limited

Course description Stem cells play a fundamental role in developmental and homoeostatic processes. A basic understanding of different stem cell types, their properties and functions in vivo is essential to use stem

cells in tissue engineering approaches. In this course, students learn about different types of stem cells (pluripotent stem cells, adult stem cells) and their niche. In addition, molecular processes that regulate cell differentiation (cell fate commitment) are addressed. Next, specific examples for pluripotent stem cells and adult stem cells and their use in tissue engineering and/or regenerative medicine are given. Finally, ethical aspects in stem cell research are discussed.

Teaching methods

Learning outcome

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

- name different types of stem cells including their properties and functions
- explain all factors involved in stem cell identity and cell fate commitment
- understand basic principles in development and tissue homeostasis
- discuss ethical aspects in stem cell research

Course contents

Prerequisites

Assessment Methods

Recommended Reading and Material

Attendance

Comments

Corporate Management

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

Course description

The course shall provide an overview over the essential elements of Management of companies, particularly in the Pharma industry, in order to prepare the students for managerial tasks in practical business life. After an introduction to basics of management (managers, environment, social responsibility) the course covers the

4 managerial steps Planning, Organizing, Leading and Control. The knowledge acquired in this course is a prerequisite for the course "Case Studies in Pharmaceutical Industry" in the 3rd semester.

Teaching methods

Lectures with Powerpoint Slides as well as discussions and several case studies.

Learning outcome

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

- define tasks and steps of the managerial process for companies as well as explain examples for "effective" and "efficient" management
- analyze the economic situation of a company as a manager, for example by using comparative data in income statements
- develop and define company goals as a manager
- make decisions as a manager as well as to explain and justify them
- recognize critical situations in terms of business ethics and develop solutions
- explain methods how to motivate employees and evaluate their applicability in practical cases
- evaluate various methods of communication for practical management
- explain leadership styles and their advantages and disadvantages for specific situations and persons
- recognize and apply suitable negotiation techniques and solutions for conflicts

Course contents

- Basics of management, decision making in business, planning, organizational structure and culture, change management, time management, managing teams, motivation of employees, leadership traits and styles, communication in business, negotiation, control of goal achievement, key factors of successful management

Prerequisites

Assessment Methods

- Written final exam

Recommended Reading and Material

- Stephen P. Robbins, David A. DeCenzo, Mary Coulter Fundamentals of Management Pearson Education, 2019, 11th Global Edition ISBN-10: 1292056541 ISBN-13: 978-1292056548

Attendance

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

Comments

Sustainability and Ethics in Work and Engineering

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

Molecular and Cellular Biology in Regenerative Medicine

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

Course description The course builds on the molecular biochemistry and cell biology knowledge acquired during the Bachelor's program, enhancing and expanding foundational concepts. Furthermore, it establishes connections between these principles and current challenges in the fields of Tissue Engineering and Regenerative Medicine, covering topics such as cell-based personalized therapies, advanced drug delivery systems, RNA-based therapeutic agents, and cutting-edge cancer models in regenerative medicine.

Teaching methods Self-study using prepared materials and quizzes - presentations by lecturers - graded and ungraded group assignments

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

- give a detailed overview of the essential genetic mechanisms of the cell (replication, transcription, translation, regulation of gene expression, repair, and recombination)
- specify cellular components (membranes, cytoskeleton), and explicate basic mechanisms underlying cell communication, cell cycle, and cell division
- update this knowledge and integrate it into the concepts of tissue engineering and regenerative medicine
- solve complex research-based thought problems, related to the above-mentioned contents

Course contents	<ul style="list-style-type: none">- DNA Replication, Recombination and Repair- Transcription, Translation and Control of Gene Expression- Cytoskeleton and Membranes- Cell Communication, Cell Cycle and Cancer- Visualization and Delivery of DNA/RNA in Regenerative Medicine- Gene Therapy and RNA Therapeutics- Active Biomaterials in Tissue Engineering Applications- Multidrug Resistance and Tumor Models in Regenerative Medicine
Prerequisites	Fundamental knowledge in biochemistry, molecular biology, and cell biology (Bachelor's level)
Assessment Methods	<ul style="list-style-type: none">- 2 written exams, both have to be positive in order to pass the course- group work
Recommended Reading and Material	<ul style="list-style-type: none">- Alberts, Bruce et al.: Molecular Biology of the Cell, Garland Science- current scientific publications provided by lecturers
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	In written exams, no aids are allowed; in group assignments, all teaching materials can be used.