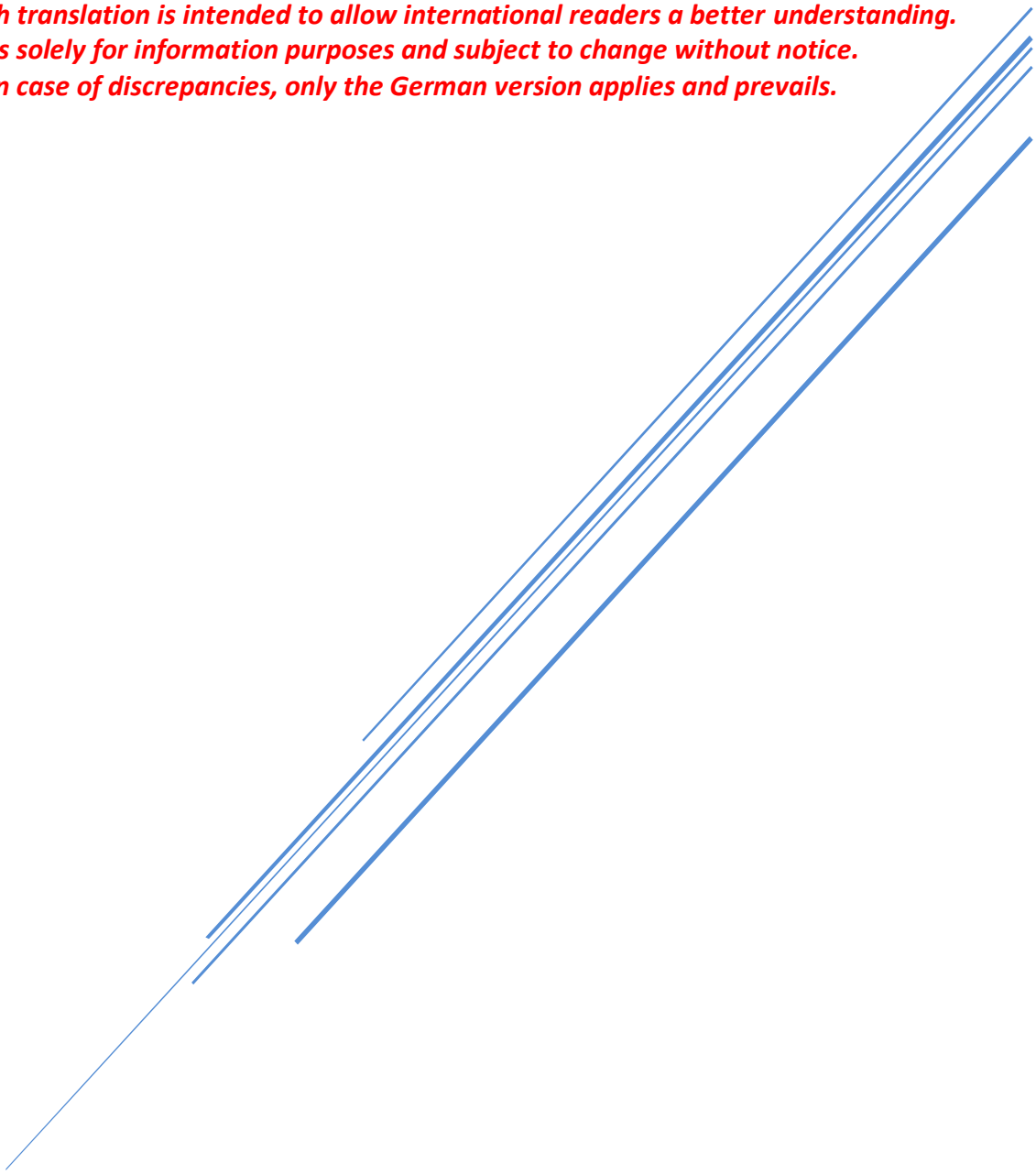
BENG INDUSTRIAL ENGINEERING – ELECTRICAL ENGINEERING BRANCH

Module Manual
Faculty of Electrical Engineering and Information Technology

SS 2020

This English translation is intended to allow international readers a better understanding.
It is solely for information purposes and subject to change without notice.
In case of discrepancies, only the German version applies and prevails.



Validity and Notes

BENG Industrial Engineering – Electrical Engineering Branch (according to the examination regulations of 2017 as last amended)

Valid for the summer semester 2020

Descriptions of the compulsory elective modules are documented in a separate module manual.

The regular semester determines in which semester the module is usually offered.

Overview of Versions

Version: WIE_WS-2018/19_v01 – September 2018
- Updates in line with current amendments to the examination regulations

Version: WIE_SS-2019_v02 – March 2019
- Editorial changes
- Updates in modules G 23, G 27, W 5, W 7

Version: WIE_WS-2019/20_v03 – September 2019
- Editorial changes
- Updates in modules G 22, G 23, G 26, W 1, W 8

Version: WIE_SS-2020_v04 – March 2020
- Updates in line with current amendments to the examination regulations
- Editorial changes
- Updates in modules G 15, W 1, W 2, W 3, W 4, W 6, W 7, W 8
- Updates in Practical Project

Abbreviations

SoSe = summer semester
WiSe = winter semester
SWS = credit hours per week
ECTS credits = credits according to the European Credit Transfer System
WIE = bachelor's programme Industrial Engineering – Electrical Engineering Branch

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Technical Modules

G 22: Fundamentals of Electrical Engineering 1

Module:		**Fundamentals of Electrical Engineering 1**		Examination no.: 11041
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		1
Lecture (L):	2	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):	1	Lecturer:		Zeise
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Introduction: overview of the history of electrical engineering, phenomena of electromagnetism und their qualitative descriptions, historical technical applications Direct current (DC) circuit: Ohm's law, electrical power and energy, network theorems, analysis of DC circuits with linear resistance, node potential and mesh current calculation for the analysis of electrical networks, electrical measuring instruments to measure current, voltage and power, introduction of electrical and magnetic fields, capacitances and coils in a DC circuit
Learning outcome / competences:	Having successfully completed the module, the students have an overview of the phenomena of electromagnetism and know fundamentals of DC modelling. They are also able to simplify and calculate more complex DC networks and to measure, process and analyse electrical parameters in DC circuits. Based on the fundamentals of electrical and magnetic fields, they have learned about capacitors and coils.
Previous knowledge required:	School mathematics: fractional arithmetic, linear algebra such as term transformation and linear systems of equations, vector and matrix calculations, simple differential and integral calculus; school physics: theory of electricity
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Hagmann: Grundlagen der Elektrotechnik, AULA-Verlag Weißgerber: Elektrotechnik für Ingenieure 1-3, Vieweg Führer et al.: Grundgebiete der Elektrotechnik 1-3, Hanser Dzieia et al.: Elektrotechnische Grundlagen der Elektronik, HPI-Fachbuchreihe, Pflaum Böge: Handbuch Elektrotechnik, Vieweg
Comments:	Students may only participate in a practical experiment once they have completed a safety briefing for the respective laboratory at the beginning of the semester.

G 23: Fundamentals of Electrical Engineering 2

Module:		**Fundamentals of Electrical Engineering 2**		Examination no.: 11051
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		2
Lecture (L): Exercise (E): Practical training (P): Seminar (S):	2 2	WiSe:		
		SoSe:		X
		Lecturer:		Zeise
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Quasi-stationary processes: alternating currents (AC), direct (DC) and mixed currents, transformation of sinusoidal currents and voltages into complex quantities, impedance, admittance, vector diagram, basic circuits, power in the alternating-current circuit, transformer. Grid feed-in of variable frequencies: locus, Bode diagram, linear representations, two-pole networks, four-pole networks, filter, resonant circuits
Learning outcome / competences:	Having successfully completed the module, the students can calculate simple AC networks using complex numbers. They know qualitative and quantitative procedures for system description in network analysis at variable frequencies. They can classify and apply frequency-dependent circuits as filters or resonant circuits in technical systems.
Previous knowledge required:	School mathematics: fractional arithmetic, linear algebra such as linear systems of equations, trigonometry, vector and matrix calculations, simple differential and integral calculus, complex numbers; school physics: theory of electricity
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Hagmann: Grundlagen der Elektrotechnik, AULA-Verlag Weißgerber: Elektrotechnik für Ingenieure 1-3, Vieweg Führer et al.: Grundgebiete der Elektrotechnik 1-3, Hanser Böge: Handbuch Elektrotechnik, Vieweg
Comments:	None

G 24: Mathematics 1

Module:		**Mathematics 1**		Examination no.: 12041
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		1
Lecture (L):	2	WiSe:		X
Exercise (E):	2	SoSe:		
Practical training (P):		Lecturer:		Kellner
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Basic concepts of logics and set theory, illustrations and functions, complex numbers, elementary functions of one complex variable
Learning outcome / competences:	Having successfully completed the module, the students know the fundamentals of the practical use of mathematical notations and concepts as well as complex numbers in a scientific context.
Previous knowledge required:	School mathematics: calculation skills in real numbers (without calculator) as well as confident term transformations (especially fraction and percentage calculation in real numbers), differentiation and integration as well as knowledge of the antiderivative of elementary functions in real numbers
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Stingl: Einstieg in die Mathematik für Fachhochschulen, Hanser Fachbuch Papula: Mathematik für Ingenieure und Naturwissenschaftler 2, Vieweg und Teubner Ansorge, Oberle: Mathematik 1&2, Wiley Zeidler, Schwarz, Hackbusch: Teubner-Taschenbuch der Mathematik, Teubner
Comments:	None

G 25: Mathematics 2

Module:		**Mathematics 2**		Examination no.: 12051
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		2
Lecture (L):	2	WiSe:		
Exercise (E):	2	SoSe:		X
Practical training (P):		Lecturer:		Kellner
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Limits and continuous functions, differential calculus for functions of a complex variable, integral calculus for functions of a real variable, Taylor series
Learning outcome / competences:	Having successfully completed the module, the students master essential techniques of differentiation and Taylor series development in complex numbers as well as standard methods to solve integrals of real functions.
Previous knowledge required:	Basic concepts of logics and set theory, illustrations and functions, complex numbers, elementary functions of one complex variable
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Stingl: Einstieg in die Mathematik für Fachhochschulen, Hanser Fachbuch Papula: Mathematik für Ingenieure und Naturwissenschaftler 2, Vieweg und Teubner Ansorge, Oberle: Mathematik 1&2, Wiley Zeidler, Schwarz, Hackbusch: Teubner-Taschenbuch der Mathematik, Teubner
Comments:	None

G 7: Fundamentals of Computer Science 1

Module:		**Digital Technology**		Examination no.: 13011
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		1
Lecture (L):	2	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):	1	Lecturer:		Gronau
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The students learn the fundamentals of illustration of information including computing rules. The areas of logic algebra (Boolean algebra), combinational logic circuits, sequential circuits including basic concepts of automata theory and methods of sequential circuit design provide the link to hardware. In addition, the students study basic digital circuits, arithmetic units and data memory. The students then get an introduction to the areas of information coding including source coding and channel coding.
Learning outcome / competences:	The use of microcontroller systems in all areas of everyday life requires extensive basic knowledge in the field of manufacturing and application of such systems. In the Digital Technology module, the students have learned the relevant fundamentals. Having successfully completed the module, they are thus able to design simple basic digital circuits independently. In addition, they have learned the fundamentals of coding, which is becoming increasingly important in signal processing. The students also know the essential characteristics and potentials of coding. The aim of the practical training is to use modern design tools to illustrate the behaviour of some of the components and design methods presented in the lecture. This involves the analysis of flip-flops on the one hand and the design of sequential circuits on the other hand. In both cases, it is about practical application of the broad subject areas discussed during the lecture. Having successfully participated in the experiments, the students are able to analyse the behaviour of flip-flops using CAD tools – and can use them in automata design. The steps performed have provided deeper insight into circuit design and consolidated the topics studied in theory. These additional considerations of the fundamentals covered in the exercises have improved the students' understanding. The workload mentioned above includes both attendance and the time used for self-study. Since the practical training only covers topics from the lecture, the students need hardly any additional time for preparations for the practical training. It is simply necessary that the students study the relevant fundamentals during the semester for the practical training and the examination.
Previous knowledge required:	Fundamentals of mathematics
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	Passed practical training (confirmation of successful completion)
Recommended literature:	Course materials
Comments:	None

G 8: Fundamentals of Computer Science 2

Module:		**Software Engineering**		Examination no.: 13021
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		2
Lecture (L):	2	WiSe:		
Exercise (E):	1	SoSe:		X
Practical training (P):	1	Lecturer:		Rieß
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The students study programming using C programming language. The module covers the following topics: data and data types, expressions, assignments and operators, algorithms and structured programming, functions, storage-class memory, pointers, input/output, files, dynamic memory and structured data types.
Learning outcome / competences:	Having successfully completed the module and the practical training, the students are able to synthesise, compile and evaluate a suitable C program for a given task. The students can apply the basic elements of C programming language in a suitable manner. During the practical training, the students have learned how to practically apply the theoretical topics covered in the lectures and exercises. In addition, they have consolidated their knowledge acquired in theory. These additional considerations and the application of the fundamentals covered in the exercises have improved the students' understanding.
Previous knowledge required:	Boolean algebra and digital technology
Type of examination and duration:	Written examination (60 min.)
Prerequisites for the examination:	Passed practical training (confirmation of successful completion)
Recommended literature:	Kernighan, Richie: Programmieren in C, Hanser Dausmann, Bröckl, Schoop, Goll: C als erste Programmiersprache, Vieweg und Teubner
Comments:	None

G 10: Fundamentals of Natural Sciences 1

Module:		**Fundamentals of Natural Sciences 1**		Examination no.: 14011
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		1
Lecture (L):	4	WiSe:		X
Exercise (E):		SoSe:		
Practical training (P):		Lecturer:		Prochotta
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Content	Physics: Mechanics: kinematics, dynamics, interactions, work and energy, particle systems, impulse, static and dynamic processes, rotary movements, mechanics of deformable bodies, fluid dynamics Materials: Structure and properties of matter, atomic structure of solids, Miller indices, disturbances of atomic structure, diffusion, mechanical, electrical and magnetic properties
Learning outcome / competences:	Having successfully completed the module, the students understand fundamental scientific matters and can derive laws from experiments. The students are able to select suitable material for given applications. They can also apply material testing methods.
Previous knowledge required:	None
Type of examination and duration:	Written examination (120 min.)
Prerequisites for the examination:	None
Recommended literature:	Tipler: Physik, Springer Berber, Kacher, Langer: Physik in Formeln und Tabellen, Springer Fischer: Werkstoffe in der Elektrotechnik: Grundlagen - Aufbau - Eigenschaften - Prüfung - Anwendung – Technologie, Hanser
Comments:	None

G 11: Fundamentals of Natural Sciences 2

Module:		**Fundamentals of Natural Sciences 2**		Examination no.: 14012
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		2
Lecture (L):	2	WiSe:		
Exercise (E):	1	SoSe:		X
Practical training (P):	1	Lecturer:		Prochotta
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Oscillations: harmonic oscillations, pendulums, damped oscillations, forced oscillations, acoustics Waves: harmonic waves, energy transfer by waves, superposition and interference, standing waves, Doppler effect, reflection, refraction, diffraction, wave packets, group phase velocity, dispersion, interactions between electromagnetic waves and matter Optics: waves and particles, reflection and diffraction, optical imaging, polarisation, optical instruments Thermodynamics: temperature, thermometer, degrees of freedom, gas state equations, laws of thermodynamics, heat transfer, heat capacity, transition, heat engine, Carnot cycle, entropy
Learning outcome / competences:	Having successfully completed the module, the students understand fundamental scientific matters from the fields of vibrations, waves, optics and thermodynamics and can derive laws from experiments.
Previous knowledge required:	Fundamentals of Natural Sciences 1, Mathematics 1
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Tipler: Physik, Springer Berber, Kacher, Langer: Physik in Formeln und Tabellen, Springer
Comments:	None

G 26: Fundamentals of Electrical Power Engineering

Module:		**Fundamentals of Electrical Power Engineering**		Examination no.: 18011
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		3
Lecture (L): Exercise (E): Practical training (P): Seminar (S):	2 1 1	WiSe:		X
		SoSe:		
		Lecturer:		Kopczynski
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Energy economics, legal fundamentals, energy transition, electrical power plants, electrical machines, structure of electrical networks, transmission means (overhead lines, cables, transformers, capacitors, compensation systems, switchgear), power system analysis, short-circuit current calculation according to VDE 0102
Learning outcome / competences:	Having successfully completed the module, the students know the fundamentals of the field of energy economics, energy conversion, transmission and distribution of electrical power.
Previous knowledge required:	Fundamentals of electrical engineering
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Heuck, Dettmann: Elektrische Energieversorgung, Vieweg Oeding, Oswald: Elektrische Kraftwerke und Netze, Springer
Comments:	None

G 27: Fundamentals of Automation Technology

Module:		**Fundamentals of Automation Technology**		Examination no.: 18021
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		3
Lecture (L):	2	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):	1	Lecturer:		Beck
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Objectives and tasks of automation technology; basic structures, systems and characteristics of automation technology; description of automation processes by block diagram; description and analysis of linear time-invariant continuous processes in the time and frequency domain; control design using setting rules; stability analysis of closed control loops; description and analysis of discrete-event systems; introduction to procedures to design control systems for discrete-event systems; introduction to programmable logic controllers and PLC programming according to IEC 61131-3; introduction to process control engineering and robotics
Learning outcome / competences:	Having successfully completed the module, the students understand and are able to modify automation systems and structures. They can solve simple control tasks and perform tests in a digital environment.
Previous knowledge required:	Fundamentals of mathematics and electrical engineering
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Langmann: Taschenbuch der Automatisierungstechnik, Hanser Litz: Grundlagen der Automatisierungstechnik, Oldenbourg Lunze: Automatisierungstechnik – Methoden für die Überwachung und Steuerung kontinuierlicher und ereignisdiskreter Systeme, De Gruyter Oldenbourg Walter: Grundkurs Regelungstechnik: Grundlagen für Bachelorstudiengänge aller technischen Fachrichtungen und Wirtschaftsingenieure, Springer Vieweg Wellenreuther, Zastrow: Automatisieren mit SPS – Theorie und Praxis, Springer Vieweg
Comments:	None

G 28: Fundamentals of Microelectronics

Module:		**Fundamentals of Microelectronics**		Examination no.: 18031
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		3
Lecture (L):	2	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):	1	Lecturer:		Scheubel
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	Introduction to sensors, base technologies, actuators Temperature sensors, force and pressure sensors, magnetic field sensors, capacitive sensors, optical sensors, humidity sensors, chemical sensors
Learning outcome / competences:	Having successfully completed the module, the students are able to deal with circuit development and hardware design. They are able to apply their knowledge of industrial ultrasonic measurement technology. During the practical training, they have learned to practically apply the knowledge acquired in the lecture. They have studied particularly the following topics in an application-oriented manner: ultrasonic sensors, circuit design and layout, soldering technique and practical measurement technology using an oscilloscope. The students can apply the fundamentals of ultrasonic sensors as well as design and test electrical circuits.
Previous knowledge required:	None
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	Passed practical training (confirmation of successful completion)
Recommended literature:	Schaumburg: Sensoren, Teubner Büttgenbach: Mikromechanik, Teubner Tietze, Schenk: Halbleiter-Schaltungstechnik, Springer
Comments:	None

G 29: Fundamentals of Information Technology

Module:		**Fundamentals of Information Technology**		Examination no.: 18041
Allocation to curriculum:		Technical Modules		
Courses	SWS	Regular semester:		3
Lecture (L):	2	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):	1	Lecturer:		Frese
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	• German
Contents:	• Reference models for network protocols • Fundamentals of communications technology and communication models • Fundamentals of information theory and source coding • Channel coding, bit error detection and correction • Fundamentals of communication protocols • Routing protocols • Throughput and flow control **Practical training (topics vary and will be announced in advance):** Reference models for network protocols, network topologies and network analysis, IPv4 subnet and configuration, CRC and spanning tree protocol Prerequisites: aptitude test
Learning outcome / competences:	• Knowledge of the fundamentals and methods of communication and information transmission • Knowledge of methods to successfully perform and plan data transmission procedures • Fundamentals of system technology of selected, realised sample transmission and communication systems • Ability to apply the methods and procedures to transmit messages and information and to estimate their efficiency • Ability to design one's own data transmission systems based on methodical knowledge / Making the optimal selection from existing system alternatives for given applications **Practical training (topics vary and will be announced in advance):** Understanding protocols and communication between different network layers, planning and creation of networks (IP configuration), CRC calculation to check data transmission, application of the spanning tree protocol to an existing network
Previous knowledge required:	Fundamentals of mathematics and electrical engineering
Type of examination and duration:	Written examination, oral examination (20–40 min.) or special type of examination. Will be announced at the beginning of the respective course.
Prerequisites for the examination:	Will be announced at the beginning of the respective course.
Recommended literature:	Göbel: Kommunikationstechnik, Hüthig Herter, Lörcher: Nachrichtentechnik, Hanser Werner: Nachrichtentechnik, Vieweg Pehl: Digitale und analoge Nachrichtenübertragung, Hüthig
Comments:	None

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Transferable Skills Modules

C 1 / G 16: Technical and Business English

Module:		**Technical and Business English**		Examination no.: 16021
Allocation to curriculum:		Transferable Skills Modules		
Courses	SWS	Regular semester:		4
Lecture (L): Exercise (E): Practical training (P): Seminar (S):	2 2	WiSe:		
		SoSe:		X
		Lecturer:		S. Meier
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	• Promotion of language skills, i.e. reading, listening, speaking and writing • Editing stylistically difficult technical texts in the fields of economics and electrical engineering • Grammar and word building exercises • Conversation and comprehension exercises • Writing up definitions • Translation techniques • Business communication
Learning outcome / competences:	Having successfully completed the module, the students can read, understand, speak and write technical English. They can comment on and summarise technical matters verbally and in writing. They can identify and use complex sentence, word building and grammatical structures in technical English texts from the field of electrical engineering. They are able to translate a text orally or in written form. They have the language skills required in international contexts (e.g. on business trips, in negotiations or meetings).
Previous knowledge required:	English language proficiency of A2 level (according to the Common European Framework of Reference for Languages)
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Business Spotlight Magazine Halliday, Resnick, Walker: Fundamentals of Physics, Wiley Rizzoni: Fundamentals of Electrical Engineering, McGraw-Hill
Comments:	None

C 2: Project Management and Business Simulation

Module:		**Project Management and Business Simulation**		Examination no.: 80041
Allocation to curriculum:		Transferable Skills Modules		
Courses	SWS	Regular semester:		4
Lecture (L):	2	WiSe:		
Exercise (E):		SoSe:		X
Practical training (P):	2	Lecturer:		Frese / Lang
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	First, the students learn to understand the essential need for project management. Then, they learn about the process as well as the relevant methods and instruments. Thanks to an individual project in small groups, the students experience challenges and possible solutions for practical problems. In addition, the students familiarise themselves with the essential objectives, characteristics and contents of a business plan. They create their own business plan in small groups in an individual project on a topic of their own choice. During the semester, the students work on this project within their groups and in regular coaching sessions and consultations with the teaching staff.
Learning outcome / competences:	Having successfully completed the module, the students can apply common methods and instruments of project management. They have developed an understanding of the approaches and instruments presented and have applied them. They can critically analyse a project plan or project. The students have experienced the interaction within a company and the impact of business decisions. They have run through business processes and learned how to create a business plan in theory. Based on the methodology of problem-oriented learning, the students have also written their own business plan independently. The teaching staff have consulted them and provided feedback during the process. As a result of this teaching-learning process, the students have learned to critically analyse business plans.
Previous knowledge required:	Fundamentals of business administration, intercultural management and business etiquette
Type of examination and duration:	Written examination, oral examination (20–40 min.) or special type of examination. Will be announced at the beginning of the respective course.
Prerequisites for the examination:	Will be announced at the beginning of the respective course.
Recommended literature:	Will be announced at the beginning of the respective course.
Comments:	None

C 3: Design Project

Module:		**Design Project**		Examination no.: 80031
Allocation to curriculum:		Transferable Skills Modules		
Courses	SWS	Regular semester:		5
Lecture (L): Exercise (E): Practical training (P): Seminar (S):	4	WiSe:		X
		SoSe:		
		Lecturer:		Lang
Total (SWS):		Workload:	Attendance (h):	30
ECTS credits:	5		Self-study (h):	120

Language of instruction:	German and English
Contents:	The students can choose between different projects from practice (in cooperation with partner companies). They work on these projects in teams – concretising the task, planning the project, putting the plan into action and presenting results. Teaching staff and partner companies are the project owners and provide subject-related consultation.
Learning outcome / competences:	Having successfully completed the module, the students are able to implement an interdisciplinary project independently. They have learned to organise themselves within a group, to divide and work on the tasks as well as to prepare the results for the project owner. Regular status meetings as well as feedback from the teaching staff and companies involved have accompanied the process. This is the basis of the didactic concept promoting the independence of the students in the context of practical tasks.
Previous knowledge required:	Intercultural management and business etiquette, project management, business administration
Type of examination and duration:	Written examination, oral examination (20–40 min.) or special type of examination. Will be announced at the beginning of the respective course.
Prerequisites for the examination:	The modules Intercultural Management and Business Etiquette, Fundamentals of Business Administration and Project Management have to be successfully completed.
Recommended literature:	Will be announced at the beginning of the respective course.
Comments:	None

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Economic Modules

G 15: Fundamentals of Business Administration

Module:		**Fundamentals of Business Administration**		Examination no.: 15041
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		1
Lecture (L):	3	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):		Lecturer:		Hermanns
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The module introduces fundamental concepts of business administration. It deals with essential decisions and functions in business administration and their application. The module includes an introductory overview of the following topics: • Location decisions • Decisions on legal form • Corporate structure • Strategy • Organisation • Procurement • Logistics • Production • Marketing • Human resources management • Financial accounting and management accounting • Controlling • Financing • Investments
Learning outcome / competences:	Having successfully completed the module, the students know the fundamentals and basic concepts of business administration. They understand the essential decisions and functions in business administration. They are able to put the contents of advanced courses on related topics into the context of business administration.
Previous knowledge required:	None
Type of examination and duration:	Written examination (120 min.)
Prerequisites for the examination:	None
Recommended literature:	Compulsory reading for the lecture: Vahs, Schäfer-Kunz (2015): Einführung in die Betriebswirtschaftslehre, Schäffer-Poeschel Further recommendations: Wöhe, Döring , Brösel (2016): Einführung in die Allgemeine Betriebswirtschaftslehre, Vahlen
Comments:	None

W 1: Intercultural Management and Business Etiquette, Quotation

Module:		**Intercultural Management and Business Etiquette, Quotation**		Examination no.: NEW
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		4
Lecture (L):	3	WiSe:		
Exercise (E):	1	SoSe:		X
Practical training (P):		Lecturer:		Lang
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	In a globalised professional environment, an understanding for different cultures and communication is critical to success. The module deals with both cultural specifics and professional conventions. The topic of quotation complements the module contents – i.e. looking at process-related and legal requirements of a quote to be tailored for successful marketing in an intercultural context.
Learning outcome / competences:	Having successfully completed the module, the students know and understand the essential elements of culture and can adapt to cultural differences in professional practice. They are able to analyse why people behave the way they do in different intercultural contexts. They can influence people's behaviour to a certain degree to achieve their own goals. They are able to communicate appropriately and behave correctly in business contexts. They have learned how to avoid and settle conflicts of interest. In addition, they are able to provide a quote which meets local legal and economic requirements as well as the client's needs – to influence the purchase decision in favour of the offering company.
Previous knowledge required:	None
Type of examination and duration:	Written examination, oral examination (20–40 min.) or special type of examination. Will be announced at the beginning of the respective course.
Prerequisites for the examination:	None
Recommended literature:	Will be announced during the course
Comments:	In SoSe 2020, this module will not yet include the part 'Quotation'.

W 2: Accounting, Annual Accounts and Controlling

Module:		**Accounting, Annual Accounts and Controlling**		Examination no.: 55021
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		3
Lecture (L):	3	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):		Lecturer:		Hermanns
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The module deals with the fundamentals of financial accounting: • Legal fundamentals of financial reporting and principles of proper accounting • Introduction to double entry accounting • Annual accounts; profit and loss account (P&L) • Fundamentals of balance sheet, profit and loss account and key figure analysis The module deals with the fundamentals of controlling: • Introduction to controlling: planning, governance and supply of information relevant for decision-making at management level • Concepts of strategic and operational controlling • Strategic and operational planning • Key figures and key figure systems • Instruments for operational controlling: traditional cost accounting methods, break-even analysis, contribution margin, absorption costing, marginal costing, activity-based costing, standard costing and variance analysis, target costing, operational planning as well as classic target-performance comparisons • Instruments for strategic controlling: BCG matrix, portfolio analysis, balanced scorecard, benchmarking, market share and potential analysis, SWOT analysis
Learning outcome / competences:	Having successfully completed the module, the students understand the fundamentals of accounting and annual accounts. They can prepare simple annual accounts and are able to calculate and interpret key figures. The students understand the main strategic and operational controlling instruments and methods.
Previous knowledge required:	Lecture: Fundamentals of Business Administration
Type of examination duration:	Written examination (120 min.)
Prerequisites for the examination:	None
Recommended literature:	Compulsory reading for the fields of annual accounts and accounting: Vahs, Schäfer-Kunz (2015): Einführung in die Betriebswirtschaftslehre, Schäffer-Poeschel Compulsory reading for the field of controlling: Brühl (2016): Controlling – Grundlagen einer erfolgsorientierten Unternehmenssteuerung, Vahlen Further recommendations: Wöhe, Döring, Brösel (2016): Einführung in die Allgemeine Betriebswirtschaftslehre, Vahlen
Comments:	None

W 3: Industrial Marketing

Module:		**Industrial Marketing**		Examination no.: 55031
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		2
Lecture (L): Exercise (E): Practical training (P): Seminar (S):	3 1	WiSe:		
		SoSe:		X
		Lecturer:		Lang
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The module teaches fundamental concepts of industrial marketing and creates a common understanding. Based on marketing goals and strategies, the students start creating a marketing concept. For this purpose, they prepare and discuss theoretical contents digitally. During the exercise, they work in groups and apply the acquired knowledge to a product to be marketed. A special focus is on the choice and use of marketing instruments. Technical implementation and current developments are gradually integrated into considerations and applications. Work might touch other business-related disciplines.
Learning outcome / competences:	The students are able to develop, implement and control marketing concepts.
Previous knowledge required:	Fundamentals of business administration
Type of examination and duration:	Written examination, oral examination (20–40 min.) or special type of examination. Will be announced at the beginning of the respective course.
Prerequisites for the examination:	None
Recommended literature:	Topic-specific literature will be recommended or provided during the respective course or via the online learning platform.
Comments:	The exercise consists of group work.

W 4: Cost Accounting, Results Accounts and Pricing

Module:		**Cost Accounting, Results Accounts and Pricing**		Examination no.: 55041
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		2
Lecture (L):	3	WiSe:		
Exercise (E):	1	SoSe:		X
Practical training (P):		Lecturer:		Hermanns
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The module deals with essential aspects of cost accounting, results accounts and pricing: • Cost accounting and results accounts as part of management accounting • Fundamentals of cost accounting and results accounts • Calculation and cost allocation • Cost element, cost centre and cost unit accounting • Determination of actual costs and manufacturing costs • Calculation of the sales price • Procedure for internal cost allocation • Structure of a cost distribution sheet • Cost trends and determination of cost functions • Tasks and procedures for profit and loss account • Break-even analysis for a product • Cost and revenue information for operational decision-making • Standard costing and variance analysis • Cost efficiency check, target-performance comparison
Learning outcome / competences:	Having successfully completed the module, the students are able to understand goals, structures and procedures of cost accounting, results accounts and pricing. The students know that cost accounting and results accounts provide essential information for corporate planning, management and control – thus supporting operational management decisions significantly.
Previous knowledge required:	Lecture: Fundamentals of Business Administration
Type of examination and duration:	Written examination (120 min.)
Prerequisites for the examination:	None
Recommended literature:	Compulsory reading for the lecture: Friedl, Hofmann, Pedell (2017): Kostenrechnung – Eine entscheidungsorientierte Einführung, Vahlen Further recommendations: Vahs, Schäfer-Kunz (2015): Einführung in die Betriebswirtschaftslehre, Schäffer-Poeschel Brühl (2016): Controlling – Grundlagen einer erfolgsorientierten Unternehmenssteuerung, Vahlen
Comments:	None

W 5: Market Research and Statistics

Module:		**Market Research and Statistics**		Examination no.: 55051
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		3
Lecture (L):	3	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):		Lecturer:		Lambeck
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The students learn the fundamentals of market research, particularly the relevant methodology: planning and organisation of market research projects. In the process, they apply essential methods of data acquisition, such as surveys, observation or experiments. At the end, they analyse, interpret and illustrate the results of their market research. Descriptive statistics provide methods to collect and present research data of mass phenomena: statistical variables, distributions, linear correlation, linear regression, mean (position measures), dispersion, probability calculation, distribution functions, density functions, corporate quality management: statistical process control, acceptance sampling
Learning outcome / competences:	Having successfully completed the module, the students are able to successfully select and apply a suitable method for a given market research question. They know how to present the results appropriately and to critically reflect on them. The students can deal with statistical data and apply the methods of descriptive statistics. They also master procedures of quality management relevant for industrial engineers.
Previous knowledge required:	Mathematics 1
Type of examination and duration:	Written examination (90 min.)
Prerequisites for the examination:	None
Recommended literature:	Will be announced at the beginning of the respective course.
Comments:	None

W 6: Investment Calculation

Module:		**Investment Calculation**		Examination no.: NEW
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		4
Lecture (L):	3	WiSe:		
Exercise (E):	1	SoSe:		X
Practical training (P):		Lecturer:		Hermanns
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The module deals with the fundamentals of investment calculation: • Introduction to investment calculation • Fundamentals of investment decisions • Investment decision-making process • Risks in investment decisions • Overview and classification of types of investment • Static methods of investment calculation: Cost comparison, earnings comparison, profitability comparison, amortisation comparison • Dynamic methods of investment calculation: Net present value method, internal rate of return method, annuity method, dynamic amortisation method • Financial business analysis and financial fundamentals for investment decisions
Learning outcome / competences:	Having successfully completed the module, the students know the basic concepts in the field of investment calculation. They understand the different aspects and risks of investment decisions. They are able to explain common investment calculation methods and understand the differences between the procedures. The students can apply common methods of investment calculation to sample situations. They can calculate and assess the advantages of simple investments.
Previous knowledge required:	Lectures: Introduction to Business Administration, Mathematics
Type of examination and duration:	Written examination (120 min.)
Prerequisites for the examination:	None
Recommended literature:	Textbook: Pape, Ulrich (2015): Grundlagen der Finanzierung und Investition, mit Fallbeispielen und Übungen, De Gruyter Oldenbourg Further recommendations: Vahs, Schäfer-Kunz (2015): Einführung in die Betriebswirtschaftslehre, Schäffer-Poeschel Wöhe, Döring, Brösel (2016): Einführung in die Allgemeine Betriebswirtschaftslehre, Vahlen
Comments:	In SoSe 2020 and 2021, this module will still include the part 'Quotation'.

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W 7: Market Analysis and Operations

Module:		**Market Analysis and Operations**		Examination no.: 55071
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		1
Lecture (L):	3	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):		Lecturer:		Lang
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The students have to analyse a defined market. Following the problem-based learning approach, they learn about the relevant methods and instruments. They apply them immediately and determine their advantages and disadvantages. Once they have completed the market analysis, they use the results to determine a suitable strategy for further market development. Finally, they document and present their market analysis. The students choose the samples for the market analysis themselves.
Learning outcome / competences:	Having successfully completed the module, the students master various techniques for market and competition analysis. They can assess the company's competitive position within the market and apply suitable techniques to concrete practical cases. They know how to analyse, define and segment a market, identify relevant competitors and determine success factors and trends within the market. The students master techniques to determine the competitive position of a company or part of a company (e.g. a selected product) within the market environment (e.g. product lifecycle, SWOT analysis). The students can assess the results in the context of the overall process of corporate strategy development. The students are able to document analysis results in writing following academic standards and to present them in an understandable way.
Previous knowledge required:	Fundamentals of business administration, market research and statistics, controlling
Type of examination and duration:	Written examination, oral examination (20–40 min.) or special type of examination. Will be announced at the beginning of the respective course.
Prerequisites for the examination:	Will be announced at the beginning of the respective course.
Recommended literature:	Will be announced at the beginning of the respective course.
Comments:	In SoSe 2020, this module will still be offered for students in their 4th semester.

W 8: Sales, Products and Services

Module:		**Sales, Products and Services**		Examination no.: 55081
Allocation to curriculum:		Economic Modules		
Courses	SWS	Regular semester:		5
Lecture (L):	3	WiSe:		X
Exercise (E):	1	SoSe:		
Practical training (P):		Lecturer:		Lang
Seminar (S):				
Total (SWS):	4	Workload:	Attendance (h):	60
ECTS credits:	5		Self-study (h):	90

Language of instruction:	German
Contents:	The module investigates which concepts, organisational form, controlling system and controlling approach are theoretically possible and which ones are applied in practice. Current practical cases illustrate different approaches used in the industries. The students learn the methodical fundamentals of design thinking to apply them in the context of product management. Thus, they develop an understanding of relevant factors of products and services from the clients' perspective – and how these are coordinated within the company.
Learning outcome / competences:	Having successfully completed the module, the students know various sales concepts. They can apply them to existing organisations and critically reflect on them. They have developed an in-depth understanding of the different concepts and critically discussed them. In addition, the students understand the basic idea of a customer relationship management (CRM) system. They have a general understanding of how to determine goals and possible functions of a CRM system. They know how important it is to successfully integrate organisational and controlling aspects into the CRM system – and have discussed solution approaches. Thanks to this fundamental knowledge, the students are able to implement such a concept systematically in professional practice. The students know the fundamentals of innovation management, product and service management as well as their fields of application. They are able to apply their knowledge to given practical problems in a given situation. They can analyse complex cases from the fields of service and product development as well as innovation management – and use the results to develop and implement solutions in a targeted manner.
Previous knowledge required:	Fundamentals of business administration, intercultural management and business etiquette, quotation
Type of examination and duration:	Written examination, oral examination (20–40 min.) or special type of examination. Will be announced at the beginning of the respective course.
Prerequisites for the examination:	Will be announced at the beginning of the respective course.
Recommended literature:	Will be announced at the beginning of each semester.
Comments:	None

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Practical Project and Bachelor's Thesis

Practical Project

Module:		**Practical Project**		Examination no.: 80021
Allocation to curriculum:		Practical Project		
Courses	SWS	Regular semester:		6
Lecture (L): Exercise (E): Practical training (P): Seminar (S):		WiSe:		
		SoSe:		X
		Lecturer:		Any member of the teaching staff
				Any member of the teaching staff
Total (SWS):		Workload:	Attendance (h):	
ECTS credits:	18		Self-study (h):	

Language of instruction:	German
Contents:	Application of the knowledge acquired in other modules and advanced study in a practical project. The project usually takes place in cooperation with a partner from the industry. In exceptional cases, the practical project can take place in a laboratory at the university. The topics worked on are highly relevant in practice. In the context of the project, the students have to develop a solution for a given problem, starting by setting a goal and time frame. Once they have developed the solution approach, they need to implement it and verify it applying instruments of quality assurance.
Learning outcome / competences:	The students are able to plan and implement a practical project independently on a scientific basis. They are able to apply their theoretical skills in practice.
Previous knowledge required:	None
Type of examination and duration:	Presentation and written assignment / minimum 8 weeks
Prerequisites for the examination:	140 ECTS credits
Recommended literature:	None
Comments:	None

Bachelor's Thesis

Module:		**Bachelor's Thesis**		Examination no.: 80001
Allocation to curriculum:		Bachelor's Thesis		
Courses	SWS	Regular semester:		6
Lecture (L): Exercise (E): Practical training (P): Seminar (S):		WiSe:		
		SoSe:		X
		Lecturer:		Any member of the teaching staff
				Any member of the teaching staff
Total (SWS):		Workload:	Attendance (h):	
ECTS credits:	12		Self-study (h):	

Language of instruction:	German
Contents:	The bachelor's thesis is a written academic assignment, which completes the programme. In this module, the students have to solve a practical problem applying academic methodology.
Learning outcome / competences:	With the bachelor's thesis, the students prove their ability – to work independently on an assignment from their specialism within a prescribed period of time, – to elaborate on subject-specific details as well as the relevant cross-disciplinary overview, –, – to apply technical, academic and practical methodology. This includes, amongst other things, assessment of relevant literature, development and assessment of new solution approaches and solution implementation. Finally, the students are able to present the results in a structured manner in writing, which includes understanding the relevant aspects of the solution.
Previous knowledge required:	None
Type of examination and duration:	Bachelor's thesis / 12 weeks
Prerequisites for the examination:	158 ECTS credits
Recommended literature:	None
Comments:	None