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COBURG UNIVERSITY of applied sciences and arts | DEPARTMENT OF Electrical Engineering and Computer Science

Module Manual
Draft Version

BACHELOR´S DEGREE COURSE AUTOMATION AND ROBOTICS (AUR)

Preamble:

SWS – semester hour

SWS is the German abbreviation for "semester hour" and indicates the number of 45-minute periods that a course comprises per week during the lecture period of a semester.

One **ECTS-Point** according to the „European Credit and Accumulation Transfer System“ corresponds to a workload of 30 hours per semester.

Please **also note** the **program- und examination regulations** of the degree program.

Study Objective:

The bachelor’s program in Automation and Robotics leads to a first academic degree that qualifies graduates for professional employment in the highly sought-after fields of electrical automation and robotics. Graduates are equipped with a broad foundation and practical skills in the field of electrical engineering and possess in-depth knowledge of the tasks and methods of automation and robotics. They can classify subject-specific topics appropriately and analyze problems using field-specific methods. As a defining feature of the program, graduates also emerge with knowledge in the natural sciences, business administration, and management-related knowledge. They can apply these skills and areas of knowledge in a solution-oriented manner to the often-interdisciplinary tasks encountered in their professional careers and quickly familiarize themselves with one of the many fields of application. Through targeted teaching and learning formats, graduates have acquired communicative, cooperative, and intercultural competencies. They demonstrate a forward-looking professional self-image and a sense of responsibility. For non-German-speaking students, the integrated development of advanced German language skills, alongside content and language integrated learning during the main study phase, facilitates scientific work in German and supports a successful transition into professional careers within German companies. Successful completion of the degree program particularly qualifies graduates to take on application-oriented technical roles and initial leadership responsibilities, for example in the field of production facilities, in automotive production, machine tool manufacturers, robot manufacturers, or in image processing. The degree also qualifies graduates for admission to a master's program.

Curriculum of Automation and Robotics																													
ECTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1W	Introduction to Advanced Mathematics					Scientific Basics					Soft Skills and Culture			Academic English Skills					German Basics 1 Level A1)					German Basics 2 Level A2)					
2S	Mathematics 1					Mechanics 1					Measurement Technology					Fundamentals of Electrical Engineering					Programming (Python)				German Basics 3 (Level B1.1)				
3W	Mathematics 2					Mechanics 2					Fluid Mechanics					Fundamental of Business Administration					Fundamentals of Computer based Measurement				Technical German 1 (Level B1.2)				
4S	Mathematics 3					Mathematical Applications (Python)					Thermodynamics					Control Systems					Electrical Drives, Power Grids and Safety				Technical German 2 (Level B2.1)				
Content Integrated Language learning																													
5W	Computermesstechnik (Computer based Measurement Technology)					Softwareentwicklung in der Automatisierungstechnik (Software Development in Automation)					Robotik Robotics					Signale und Systeme (Signal and Systems)					Wahlpflichtfach 1 (Elective Subject 1)				Technical German 3 (Level B2.2)				
6S	Automatisierungstechnik (Factory Automation)					Motion Control					Seminar Automatisierung-stechnik und Robotik (Seminar Automation & Robotics)					Industrielle Bildverarbeitung (Industrial Image Processing)					Wahlpflichtfach 2 (Elective Subject 2)				Introduction in Scientific Writing (Level C1.1)				
7W	Industrial Internship - Industriepraktukum																									(Block) Seminars accompanying Internship				
8S	Bachelor Thesis													Bachelor Colloquium		Engineering Project										Wahlpflichtfach 3 (Elective Subject 3)				

Language Learning

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1. First Study Phase – Semester 1

Name of Module	**Academic English Skills**
Abbreviation	
Form of Teaching / SWS	Online / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising: ▪ 60 contact hours ▪ 90 hours self-study
Semester	1
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	▪ Cultural awareness: recognition of cultural influences in the professional and academic environments. ▪ Academic and professional writing: techniques for correspondence, research reports and papers, as well as learning citation and referencing systems (e.g., APA, MLA). ▪ Academic reading: strategies for understanding and analysing scientific texts, critical reading and extracting relevant information from specialist literature. ▪ Critical thinking: methods for analyzing, evaluating and synthesizing information to develop one's own scientific arguments.

	▪ Vocabulary and terminology: development of a subject-specific vocabulary and academic idioms. ▪ Grammar and style: development of grammatical structures and stylistic devices that are common in an academic context. ▪ Oral communication: techniques for holding academic presentations and participating in academic discussions. ▪ Listening comprehension: strategies for understanding lectures, seminars and academic discussions.
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**German Basic 1 (Level A1)**
Abbreviation	
Form of Teaching / SWS	Online / 6 SWS
Credits	5 ECTS
Workload	Overall workload: 180 hours, comprising ▪ 67,5 contact hours ▪ 112,5 hours self-study
Semester	1
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German and English
Use in other Programs	▪ BA Automation and Robotics ▪ BA Digital Business Models and Technologies ▪ BA Engineering Physics ▪ BA Mechanical Engineering
Formal Requirements	Students are only permitted to enter the second semester (second stage of study) if they have completed the German Basics 1 (Level A1) modules in accordance with the annex to the study and examination requirements.
Other Requirements	n/a
Qualification Goals / Competences	**Language Proficiency A1 (Basic User, CEFR)** **Spoken interaction** o *Can describe simple aspects of daily life in a sequence of simple sentences, using simple words and elementary phrases where preparation is possible.* o *Can describe him/herself (name, age, family) using simple words and formulaic expressions where preparation is possible.* o *Can name an object (shape/colour) using elementary words and formulaic expressions where preparation is possible.* **Reading Comprehension**

	○ *Can understand short texts on topics of personal interest (e.g. course announcements or stories on sport, music, travel) written in simple words and supported by illustrations and pictures.* ○ *Can find and understand simple and important information in advertisements for special events, on handouts and in brochures (e.g. what is on offer, costs and prices, dates and places of events, departure times, etc.).* ○ *Can understand short and simple messages (e.g. posts on social media or emails) suggesting when and where to meet.* **Written production** ○ *Can give information on matters of personal relevance (e.g. likes and dislikes, family, pets) using simple words/signs and elementary expressions.* ○ *Can give basic personal information in writing (e.g. name, address, nationality), using the dictionary where appropriate.* ○ *Can use very simple words/signs and phrases to describe certain everyday objects (for example, the colour of a car, whether it is big or small).*
Content	Students acquire linguistic and cultural competences (reading, listening, writing and speaking skills) for everyday life and study in German. German is usually the second, third or additional language English. It is of central importance for multilingual learners to recognise the language as a system (language comparison). In this way, they develop a deeper understanding of linguistic structures (grammar, lexis) and the cultural context, which improves their ability to communicate independently in everyday life. Students can furthermore use language assistants, apps, online resources and similar tools to manage and expand their language learning.
Grading and Examination Achievements	Written exam (90 minutes)
Additional Assignments	**Learning material:** **Kurs DaF A1.** Deutsch für Studium und Beruf, Kurs- und Übungsbuch. 2023. KLETT: ISBN 978-3-12-676838-2 **Kurs DaF A1.** Deutsch für Studium und Beruf Kurs- und Übungsbuch, 2023. Hybride Ausgabe allango, KLETT: ISBN 978-3-12-676841-2.
Technical Tools	Notebook, Tablet, Headphones
Literature	1. Council of Europe: Global scale - Table 1 (CEFR 3.3): Common Reference levels (coe.int) Council of Europe: Official translations of the CEFR Global Scale (coe.int) [03.04.25] 2. Gemeinsamer Europäischer Referenzrahmen für Sprachen: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] 3. Glaboniat, M.; Müller, M.;Rusch, P.; Schmitz, Helen; Werten-

	schlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4.

Name of Module	**German Basic 2 (Level A2)**
Abbreviation	
Form of Teaching / SWS	12 SWS
Credits	7 ECTS
Workload	Overall workload: 360 hours, comprising ▪ 135 contact hours ▪ 225 hours self-study
Semester	1
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German and English
Use in other Programs	▪ BA Automation and Robotics ▪ BA Digital Business Models and Technologies ▪ BA Engineering Physics ▪ BA Mechanical Engineering
Formal Requirements	Students are only permitted to enter the second semester (second stage of study) if they have completed the German Basics 1 (Level A1) modules in accordance with the annex to the study and examination requirements.
Other Requirements	n/a
Qualification Goals / Competences	**Language Proficiency A2 (Basic User, CEFR)** **Spoken interaction** o *Can give a short, straightforward presentation on a familiar topic in own field with sufficient clarity to be followed with most effort, explaining the main points with sufficient precision.* o *Can describe plans and arrangements, habits and daily activities and talk about past activities and personal experiences*. o *Can report on aspects of own daily life, e.g. people, places, experiences in work and education.* **Reading Comprehension**

	○ *Can understand very simple formal emails and letters (e.g. confirmations of bookings or online purchases) / Can understand short personal letters.* ○ *Can find concrete, predictable information in simple everyday texts, e.g. advertisements, leaflets, menus, bibliographies and timetables.* ○ *Can understand a short factual presentation or report on own field of interest provided it is written in simple language and does not contain unpredictable details.* **Written production** ○ *Can write in connected sentences about everyday aspects of own environment, such as people, places, a job or study experiences.* ○ *Can write a series of simple sentences about own family, personal circumstances, educational background, current or previous occupation.* ○ *Can write a very short, elementary description of events, past actions and personal experiences.*
Content	Students acquire linguistic and cultural competences (reading, listening, writing and speaking skills) for everyday life and study in German. German is usually the second, third or additional language English. It is of central importance for multilingual learners to recognise the language as a system (language comparison). In this way, they develop a deeper understanding of linguistic structures (grammar, lexis) and the cultural context, which improves their ability to communicate independently in everyday life. Students can furthermore use language assistants, apps, online resources and similar tools to manage and expand their language learning.
Grading and Examination Achievements	Written exam (90 minutes)
Additional Assignments	**Learning material:** **Kurs DaF A2.** Deutsch für Studium und Beruf, Kurs- und Übungsbuch. 2024. KLETT: ISBN 978-3-12-676840-5. **Kurs DaF A2.** Deutsch für Studium und Beruf Kurs- und Übungsbuch. 2024. Hybride Ausgabe allango, KLETT: ISBN 978-3-12-676840-5.
Technical Tools	Notebook, Tablet, Headphones
Literature	4. Council of Europe: Global scale - Table 1 (CEFR 3.3): Common Reference levels (coe.int) Council of Europe: Official translations of the CEFR Global Scale (coe.int) [03.04.25] 5. Gemeinsamer Europäischer Referenzrahmen für Sprachen: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] 6. Glaboniat, M.; Müller, M.;Rusch, P.; Schmitz, Helen; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel.

	Stuttgart: Klett, ISBN 978-3-12-606518-4.

Name of Module	**Introduction to Advanced Mathematics**
Abbreviation	
Form of Teaching / SWS	Online / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	1
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	Numbering systems ▪ Calculating with rational numbers ▪ Percentages ▪ Real and complex numbers Important real-value functions ▪ Potencies and roots ▪ Logarithms ▪ Sine and cosine, tangent Basic equations ▪ The Linear and quadratic equation ▪ Fractional equations ▪ Root and exponential equations ▪ Triogonometric equations

	Fundamentals of geometry ▪ Triangle theorems, similar triangles ▪ Area of plane shapes ▪ Surface area, body volume ▪ The Cartesian coordinate system
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Scientific Basics**
Abbreviation	
Form of Teaching / SWS	Online / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	1
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	Physical quantities and their units ▪The International System of Units ▪Physical constants of nature ▪Dealing with very small / large values, prefixes Basics of experimentation ▪ Planning and conducting experiments ▪ Observation and data collection ▪ Evaluation, conclusion and documentation The Structure of atoms ▪ Structure of atomic nuclei und nuclear reactions ▪ Bohr's atomic model ▪ Atomistic interpretation of physical effects Chemical and physical bonding ▪ Energetically stable atoms and the octet rule

	▪ Ionic and metallic bond ▪ Covalent bond (electron pair bond) ▪ The van der Waals interaction, hydrogen bond The states of matter ▪ Solids, liquids, gases and plasma state ▪ The change of the aggregte state, phase diagrams ▪ Mixtures of substances ▪ Some selected physical properties of matter Chemical reactions and stoichiometry ▪ Reaction equation, law of conservation of mass ▪ Exothermic and endothermic reactions
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Soft Skills and Culture**
Abbreviation	
Form of Teaching / SWS	Online / 2 SWS
Credits	3 ECTS
Workload	Overall workload: 90 hours, comprising ▪ 20 contact hours ▪ 40 hours self-study ▪ 30 hours attended event (blocked in Coburg and surroundings)
Semester	1
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	Historical context from Middle Ages to Germany today. Political system and its main consequences. Cultural awareness and cross-cultural communications. Understanding the German/European mindset. Working together and the German work culture. Studying in Germany. Some typical German customs. Excursions to the Coburg area and its Neighbors.
Grading and Examination Achievements	

Additional Assignments	
Technical Tools	
Literature	

2. Second Study Phase – Semester 2 to 4

Name of Module	**Control Systems**
Abbreviation	
Form of Teaching / SWS	In-person and online (alternating) / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	4
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr. Kühnlenz
Lecturer	Prof. Dr. Kühnlenz
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	**Systems modeling and analysis** *System modeling and representation* • differential equations, transfer function, Nyquist-plot, Bode-diagram, state-space • analysis of system characteristics • linearization • Closed-loop structure • **Control plants** *Typical controllers and plants* • P, I, D, PT_n,PDT_1

	• **Stability** Analysis of systems stability • BIBO and Lypubov-Stability • Routh-Hurwitz criterion • Lypunov's direct method **Closed-loop control** *Structures and performance criteria* • typical controller-plant combinations • performance parameters • controller design in time- and frequency domain
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Electrical Drives, Power Grids and Safety**
Abbreviation	EANz
Form of Teaching / SWS	In-person lecture (2 SWS), in-person exercise (1 SWS), in-person practical work (1 SWS) / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	4
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr. Omid Forati Kashani
Lecturer	Prof. Dr. Omid Forati Kashani, Prof. Dr. Michael Rossner
Language of Instruction and Examination	English
Use in other Programs	AU
Formal Requirements	
Other Requirements	Prior knowledge about complex calculation in the field of AC-Current and vector diagrams. Basic knowledge about magnetic fields and electronic components. Knowledge about mechanics and relations between mechanical quantities.
Qualification Goals / Competences	In this module students study fundamentals of DC Machines and topologies of static converters which can be used feeding DC Machines. They study also fundamentals of three-phase systems generating a rotational magnetic field in a three-phase machine. Based on that rotating magnetic field the students understand how induction and synchronous Machines work. They will be able to draw and apply various characteristic curves of three-phase Machines, gaining the ability to solve electromechanical problems in steady state cases regarding electrical and mechanical quantities. In electrical grids part of the module students study the fundamentals of electrical energy transmission and power analysis in three-phase grids. They understand the advantages and disadvantages of different grid configurations and their safety aspects. They will be also familiar with calculation methods for short circuit currents, voltage drops and cable dimensioning.

Content	DC Machines - Structure and mode of operation, armature winding of a DC machine, air gap fields and operating behavior, voltage generation and torque, types of DC machines, characteristics and control of DC machines, no-load characteristic, speed-torque characteristic, methods for speed changing - Structure and mode of operation of power converters for drives with DC Machines: buck converters, boost converters, four-quadrant converters. Introduction to three-phase systems - Balanced three-phase system, unbalanced three-phase system, currents and voltages of balanced and unbalanced systems. Three-phase power, power factor. Three-phase induction Machines - Generation of rotating magnetic fields, displaced three-phase windings - Structure and operation of induction Machines, voltage equations and equivalent circuit, power balance, speed- or slip-torque characteristic curve, speed control of induction Machines, operating range of the three-phase induction Machines, starting, special designs of the squirrel-cage rotor. Three-phase synchronous Machines - Structure and operation of synchronous Machines, equivalent circuit and vector diagram of cylindrical-rotor synchronous Machines, island mode and grid connected operation of the cylindrical-rotor synchronous Machines, V-curves of the cylindrical-rotor synchronous Machines, torque and stability of the cylindrical-rotor synchronous Machines, structure and special features of the salient pole Machines, torque and stability of the salient pole machines. Power grids and safety - Types of energy transmission (direct current, alternating current, three-phase current), power and power measurement in three-phase power grids. Short-circuit calculations (balanced and simple cases of unbalanced circuits), power grid configuration typs (TN, TT, IT), fuse elements, protection regulations. Cable structures, installation methods, voltage drop calculations.
Grading and Examination Achievements	Written exam and practical study work
Additional Assignments	

Technical Tools	Blackboard, overhead / beamer / document camera /white-board Electronically provided work documents and exercises, practical exercises on the test bench in the laboratory
Literature	- Rolf Fischer, Elektrische Maschinen, Karl Hanser Verlag München - Helmut Späth, Elektrische Maschinen und Strom-richter, Verlag Braun Karlsruhe - Johannes Teigelkötter, Energieeffiziente elektri-sche Antrie-be, Springer Verlag - Joachim Specovius, Grundkurs Leistungselektro-nik, Springer Verlag - Germar Müller und Bernd Ponik, Grundlagen elektrischer Maschinen, WILEY-VCH Verlag GmbH & Co. KGaA - Gerhard Kiefer, VDE 0100 und die Praxis; VDE Verlag - Ismail Kasikci, Projektierung von Niederspan-nungs- und Sicherheitsanlagen, Hüthig und Pflaum - Klaus Heuck, Klaus-Dieter Dettmann; Elektrische Energie-versorgung; Vieweg-Verlag

Name of Module	**Fundamentals in Computer-based Measurement Technology**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	3
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics ▪ BA Mechenical Engineering
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	Measurement technology is a fundamental prerequisite for conducting physical experiments, as well as for technological development and progress. Today, it is standard practice to collect measurement data digitally and via computer to process it further. In this module, you will get to know common sensors and learn how to condition their signals using appropriate measurement circuits so that they can be captured with the help of an analog-to-digital converter. You will also learn how to transfer the data to a PC and evaluate it there. In the lab, you will build the measurement circuits on your own breadboard, read various sensor signals using a microcontroller, and develop corresponding measurement programs on the PC.

Content	**Lecture:** • **Introduction** Fundamentals of measurement technology, mechanical, electronic, and computer-based measurement, measurement chain • **Sensors** Detection of mechanical, thermodynamic, electromagnetic, and optical quantities • **Signal Conditioning** Conversion of measurement signals into voltage, amplification, adjustment of the measurement range • **Data Acquisition** Number systems in computing, sample & hold, DAC, ADC, measuring instruments, sampling theorem, windowing • **Interfaces & Protocols** Communication model, network topologies, RS-232, USB, GPIB, VISA, SCPI • **Data Processing** Digital filters, DFT **Lab:** The lab is based on individual experiment kits per student consisting of a prototype breadboard and a Raspberry Pi Pico microcontroller. The following topics are covered: • **Project Introduction** First MicroPython script, measurement with a photodiode • **Measurement of Small Voltages** Operational amplifiers, assembly of inverting and differential amplifiers, measurement of a thermocouple • **Measurement of Currents** Shunt resistor, transimpedance amplifier, measurement of a photodiode • **Measurement of Resistances** Building a Wheatstone bridge with an instrumentation amplifier, RTD, measurement of a strain gauge • **Building a Multimeter** Connecting an external 16-bit ADC, analog frontend for measuring voltage and current,

	MicroPython script with command interpreter for communication with a PC, Python GUI
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Fundamentals of Business Administration**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	3
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	Introduction to Business Administration ▪ Terms & General Contexts in Business Administration ▪ Development of Business Administration Management Process ▪ Corporate Goals ▪ Planning ▪ Decision-Making ▪ Control ▪ Organization Constitutive Decisions ▪ Business Model ▪ Location Choice ▪ Cooperation ▪ Legal Form Individual Functional Areas According to Porter's Value Chain ▪ Research and Development ▪ Procurement and Materials Management ▪ Production

	▪ Marketing and Sales ▪ Logistics ▪ Customer Service ▪ Finance ▪ Human Resources ▪ IT
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Fundamentals of Electrical Engineering**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	2
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr. Hüttl
Lecturer	Prof. Dr. Hüttl
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	**Direct current technology** ▪ Simple electrical direct current circuits: Ohm's law, mesh-, node-, voltage- and current divider rules, ▪ Model of ideal and real linear voltage and current sources, ▪ Methods for calculating linear direct current networks: branch current-, mesh current- and node potential methods. **Alternating current technology** ▪ Stationary sinusoidal alternating current in real representation, ▪ Linear two-pole alternating current technology: capacitors and coils, ▪ Simple circuits (series and parallel circuits) and oscillating circuits. **Electric field**

	▪ Introduction to the topics of electric charge, field strength, voltage, potential and capacitance, ▪ Calculation of electrostatic fields and potential fields for simple geometries, ▪ Matter in the electric field and polarization; energy and forces of the electric field, ▪ Fields of layered arrangements, ▪ Electric flow field. **Magnetic field** ▪ Introduction to the static magnetic field in a vacuum: magnetic phenomena, Lorentz force and magnetic flux density, flow law and magnetic field strength, ▪ Magnetic field in matter: para-, dia- and ferromagnetism, permeability, simple magnetic circuits, ▪ Electromagnetic induction law: motion and rest induction, self-induction and mutual induction, ▪ Energy and forces of the magnetic field.
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**German Basics 3 (Level B1.1)**
Abbreviation	
Form of Teaching / SWS	4 SWS
Credits	5 ECTS
Workload	Overall workload: 120 hours, comprising ▪ 45 contact hours ▪ 75 hours self-study
Semester	2
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German and English
Use in other Programs	▪ BA Automation and Robotics ▪ BA Digital Business Models and Technologies ▪ BA Engineering Physics ▪ BA Mechanical Engineering
Formal Requirements	n/a
Other Requirements	n/a
Qualification Goals / Competences	**Language Proficiency B1.1 (Independent User, CEFR)** **Spoken interaction** o *Can give straightforward descriptions or reports on a range of familiar topics in own field of interest* o *Can give short reasons or explanations for views, plans or actions.* o *Can give a prepared, straightforward presentation on a familiar topic in own field in such a way that it can usually be followed with ease, explaining the main points with sufficient precision.* **Reading Comprehension** o *Can understand short texts on topics of personal interest (e.g. course announcements or stories on sport, music, travel) written in simple words and supported by illustrations and pictures.* o *Can understand short and simple messages (e.g. posts on social media or emails) suggesting when and where to meet.*

	○ *Can read uncomplicated non-fiction texts on topics related to own interests and areas of expertise with pacifying understanding.* **Written production** ○ *Can produce straightforward, coherent text on a range of familiar topics within his/her field of interest, linking individual shorter passages in a linear sequence.* ○ *Can write a very short, elementary description of events, past actions and personal experiences* ○ *Can summarise, report and comment with some confidence on a wide range of factual information in his/her field, both on familiar routine matters and on less routine matters.*
Content	Students acquire linguistic and cultural competences (reading, listening, writing and speaking skills) for everyday life and study in German. German is usually the second, third or additional language English. It is of central importance for multilingual learners to recognise the language as a system (language comparison). In this way, they develop a deeper understanding of linguistic structures (grammar, lexis) and the cultural context, which improves their ability to communicate independently in everyday life. Students can furthermore use language assistants, apps, online resources and similar tools to manage and expand their language learning.
Grading and Examination Achievements	Written exam (90-120 minutes)
Additional Assignments	**Learning material:** **Kurs DaF B1.** Deutsch für Studium und Beruf, Kurs- und Übungsbuch. 2025. KLETT: ISBN 978-3-12-676842-9. **Kurs DaF B1.** Deutsch für Studium und Beruf Kurs- und Übungsbuch. 2024. Hybride Ausgabe allango, KLETT. Subject-specific learning materials will be provided in the course.
Technical Tools	Notebook, Tablet, Headphones
Literature	7. Council of Europe: Global scale - Table 1 (CEFR 3.3): Common Reference levels (coe.int) Council of Europe: Official translations of the CEFR Global Scale (coe.int) [03.04.25] 8. Gemeinsamer Europäischer Referenzrahmen für Sprachen: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] 9. Glaboniat, M.; Müller, M.;Rusch, P.; Schmitz, Helen; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4.

Name of Module	**Mathematical Applications**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	4
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	Numerical Methods for ▪ Integration ▪ Solving Differential Equations (PDE, ODE) ▪ Solving Large-Scale Linear Systems Statistics and Data Analysis ▪ Data Visualization ▪ PCA ▪ SVD Signal Processing ▪ Fourier Transforms (DFT, FFT) ▪ FIR and IIR Filters ▪ Spectral Analysis Optimization and Machine Learning ▪ Linear and Nonlinear Optimization

	▪ Gradient-Based Methods ▪ Introduction to Machine Learning: Classification, Regression, Clustering Modeling and Simulation ▪ Physical Modeling with Differential Equations ▪ Monte Carlo Methods ▪ Stochastic Simulations and Random Processes
Grading and Examination Achievements	Practical coursework
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Mathematics 1**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 67.5 contact hours ▪ 82.5 hours self-study
Semester	2
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	▪ Set Theory ▪ Fundamentals of Complex Numbers ▪ Limits, Sequences, and Series ▪ Differential and Integral Calculus of Univariate Real-Valued Functions ▪ Matrices and Determinants ▪ Vector Spaces ▪ Linear Systems of Equations ▪ Algebraic Equations (up to Third Order)
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Mathematics 2**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 67.5 contact hours ▪ 82.5 hours self-study
Semester	3
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	▪ First-Order Ordinary Differential Equations ▪ Higher-Order Linear Ordinary Differential Equations ▪ Vector Calculus (Multiple Integrals, Total Differential) ▪ Partial Differential Equations ▪ Systems of Linear Differential Equations ▪ Fundamentals of Numerical Integration
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Mathematics 3**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 67.5 contact hours ▪ 82.5 hours self-study
Semester	4
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics ▪ BA Mechanical Engineering
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	This course provides key mathematical tools for modeling and analyzing engineering systems, emphasizing transformations and advanced calculus. Topics include Laplace and Fourier methods for signal analysis, discrete and Z-transforms for digital systems, and advanced integration and differential equations for multi-dimensional and dynamic problems. These foundations support applications in control systems, physics, and computational engineering.

Content	• Laplace Transform
	• Fourier Series & Transform
	• Discrete Fourier Transform
	• Z-Transform
	• Advanced Topics in Mathematics
	  ○ Line Integrals, Multiple Integrals, Surface Integrals
	  ○ Integral Theorems
	  ○ Partial Differential Equations
	  ○ Systems of Linear Differential Equations

Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Measurement Technology**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	2
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr. Friedel
Lecturer	Prof. Dr. Friedel
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering, ▪ BA Electrical Engineering for Sustainable and Renewable Energy, ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	▪ Basic concepts of measurements: units and standards, traceability, calculation of uncertainty, types of measurement errors, error propaga-tion, documentation ▪ Measuring Instruments: Principle of measurement, structure/characteristics of analogue and digital multimeters, princi-ple/operation of analogue and digital oscilloscopes ▪ Sensors: physical principles, common types, fabrication technologies, applications

	▪ Methods for measurement of static and dynamic electrical quantities: Current/voltage measurement, transient measurements, measurement range extension and measuring bridges, measurement of resistance and power, time and frequency, and other quantities ▪ Periodic Measurement Quantities Averaging measured values from time diagrams, transformation to the frequency domain, representation of periodic measurement quantities as spectra, deriving characteristic values thereof and analysis of relationships between time and the spectrum ▪ Digital Measurement Technology Sampling and amplitude quantization, quantization uncertainty, analogue/digital converters ▪ Practical Experiments Application of the theoretical content, such as basic measurement methods and characteristics of periodic measurement signals
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Mechanics 1**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	2
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering, ▪ BA Electrical Engineering for Sustainable and Renewable Energy, ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	▪ Students can reproduce the fundamentals of static equilibrium in rigid bodies. ▪ Students can construct free-body diagrams of rigid bodies in both plane and space. ▪ Students develop solution strategies for determining support and joint reactions, as well as for calculating internal forces in rigid bodies and systems of rigid bodies. ▪ Students can determine the internal section forces of rods, torsion bars, and bending beams. ▪ Students can calculate the stress states of rods, torsion bars regarding statically indeterminate problems. ▪ Students can explain component stresses, principal stresses, and equivalent stresses (Maximum Principal Stress Theory (MPST), Maximum Shear Stress Theory (MSST) and Maximum Distortion Energy Theory (MDET)).

	▪ Students can characterize materials and develop the necessary procedure for a static strength verification.
Content	▪ Vector Calculus ▪ Force and moment equilibrium at a point, in rigid bodies, and in systems of rigid bodies ▪ Internal section forces ▪ Mechanical material properties / tensile test ▪ Strains ▪ Stresses / strength hypotheses
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Mechanics 2**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	3
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	Fundamentals of kinematics Mathematical description of the movement of bodies ▪ Definition of velovity and acceleration ▪ Cartesian and polar Coordinates ▪ Linear and circular kinematics of the point ▪ Planar movements of rigid bodies ▪ Momentary pole, ideal rolling processes Kinetics of the mass point Analysis of motion processes with the mass point model ▪ The basic dynamic equation (second Newton's axiom) ▪ Free and guided movements with and without resistance forces ▪ Introduction to one-dimensional oscillations ▪ Momentum theorem and straight, central impact processes Kinetics of the rigid body Analysis of plane movements of rigid bodies

	▪ Rotation around fixed axes o Definition of angular momentum o Torque set, the moment of inertia and Steiner's theorem ▪ The general plane movement, rolling processes Definition of Work, Energy, Power Meaning and simple formulas of these physical quantities
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Programming (Python)**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	2
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr. Merhof
Lecturer	Prof. Dr. Merhof
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	**Fundamentals of Programming with Python** *What is programming? Why Python?* *Setting up the development environment* **Variables, Data Types, and Expressions** *Variable assignment and core data types (int, float, str, bool)* *Type conversions and basic operations (arithmetic, comparison, logical)* **Control Structures** *Conditional statements: if, elif, else* *Loops: for, while, with break and continue* *Nested conditions and loops* **Basic Data Structures and Functions** *Lists and tuples: creation, access, modification* *Dictionaries and sets: key-value pairs, set operations* *Defining and calling functions*

	Parameters, return values, scope of variables **Files and Exceptions** *Reading/writing files, file modes* *Basic exception handling with try, except, finally* **Object-Oriented Programming** *Classes, objects, constructors* *Inheritance, polymorphism, method overriding* **Modules and Libraries** *Using and creating modules, working with packages (e.g. pip)*
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Technical German 1 (Level B1.2)**
Abbreviation	
Form of Teaching / SWS	4 SWS
Credits	5 ECTS
Workload	Overall workload: 120 hours, comprising ▪ 45 contact hours ▪ 75 hours self-study
Semester	3
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German
Use in other Programs	▪ BA Automation and Robotics ▪ BA Digital Business Models and Technologies ▪ BA Engineering Physics ▪ BA Mechanical Engineering
Formal Requirements	n/a
Other Requirements	n/a

Qualification Goals / Competences	**Language Proficiency B1.2 (Independent User, CEFR)** **Spoken interaction** o *Can talk about everyday topics or more specialised topics from own subject domain in an understandable way and give an opinion.* o *Can give and explain short, simple technical information, tasks or problems.* o *Can present information and ideas in a comprehensible way and use simple arguments to support them.* **Reading Comprehension** o *Can understand the content of detailed instructions and assignments (e.g. the task of selecting specific information from a specialised text).* o *Can take relevant information from short and specialised texts for lectures and seminars.* o *Can understand information for instruments and methods in my technical subject area when it is read repeatedly.* **Written production** o *Can take notes from basic articles or contributions on common specialised topics of general interest.* o *Can write simple texts (e.g. descriptions of experiments) on everyday topics and on more specialised topics from own subject domain.* o *Can summarise, report and comment with some confidence on a wide range of factual information in his/her field, both on familiar routine matters and on less routine matters.*
Content	Students acquire linguistic and cultural competences (reading, listening, writing and speaking skills) for everyday life and study in German. German is usually the second, third or additional language English. It is of central importance for multilingual learners to recognise the language as a system (language comparison). In this way, they develop a deeper understanding of linguistic structures (grammar, lexis) and the cultural context, which improves their ability to communicate independently in everyday life.
Grading and Examination Achievements	Written exam (90-120 minutes)
Additional Assignments	**Learning material:** **Kurs DaF B1.** Deutsch für Studium und Beruf, Kurs- und Übungsbuch. 2025. KLETT: ISBN 978-3-12-676842-9. **Kurs DaF B1.** Deutsch für Studium und Beruf Kurs- und Übungsbuch. 2024. Hybride Ausgabe allango, KLETT. Subject-specific learning materials will be provided in the course.
Technical Tools	Notebook, Tablet, Headphones

Literature	10. Council of Europe: Global scale - Table 1 (CEFR 3.3): Common Reference levels (coe.int) Council of Europe: Official translations of the CEFR Global Scale (coe.int) [03.04.25] 11. Gemeinsamer Europäischer Referenzrahmen für Sprachen: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] 12. Glaboniat, M.; Müller, M.;Rusch, P.; Schmitz, Helen; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4.

Name of Module	**Technical German 2 (Level B2.1)**
Abbreviation	
Form of Teaching / SWS	4 SWS
Credits	5 ECTS
Workload	Overall workload: 120 hours, comprising ▪ 45 contact hours ▪ 75 hours self-study
Semester	4
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German
Use in other Programs	BA Digital Business Models and Technologies
Formal Requirements	Students can only attend this course if they have completed the German Basics 3 (Level B1.1) modules in accordance with the annex to the study and examination requirements.
Other Requirements	n/a
Qualification Goals / Competences	**Language Proficiency B2.1 (Independent User, CEFR)** **Spoken interaction** o *Can actively participate in conversations and discussions in conversational situations and clearly justify and defend his/her views with explanations, arguments or comments.* o *Can give relatively clear and detailed descriptions of many topics in own subject or field of interest.* o *Can handle more complex language situations when dealing with authorities or service providers.* **Reading Comprehension** o *Can understand relatively fully information, arguments or opinions in texts on topics related to own area of study or interest.* o *Can understand detailed reports, analyses and commentaries discussing contexts, opinions and viewpoints.* o *Can quickly find key details in long and complex general and specialised texts.*

	Written production ○ *Can give a clearly structured presentation in the subject area and field of interest, varying from the prepared text where necessary and responding to questions from the audience.* ○ *Can take up arguments from different text references in a text and weigh them against each other.* ○ *Can comprehensively present a topic he/she has researched in a report or essay, summarising the opinions contained and listing and evaluating detailed information or facts.*
Content	Students acquire linguistic and cultural competences (reading, listening, writing and speaking skills) for everyday life and study in German. German is usually the second, third or additional language English. It is of central importance for multilingual learners to recognise the language as a system (language comparison). In this way, they develop a deeper understanding of linguistic structures (grammar, lexis) and the cultural context, which improves their ability to communicate independently in everyday life. – This course is baed on the CLIL model.
Grading and Examination Achievements	Written exam (90-120 minutes)
Additional Assignments	**Learning material:** Subject-specific learning materials will be provided in the course.
Technical Tools	Notebook, Tablet, Headphones
Literature	13. Council of Europe: Global scale - Table 1 (CEFR 3.3): Common Reference levels (coe.int) Council of Europe: Official translations of the CEFR Global Scale (coe.int) [03.04.25] 14. Gemeinsamer Europäischer Referenzrahmen für Sprachen: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] 15. Glaboniat, M.; Müller, M.;Rusch, P.; Schmitz, Helen; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4. 16. Heine, L.. 2015. „Lernziele“. In: Zeitschrift für Interkulturellen Fremdsprachenunterricht 20: 2, 15-20. Online abrufbar unter http://tujournals.ulb.tu-darmstadt.de/index.php/zif/ [10.04.25]. 17. Lindemann, B. 2015. In: Zeitschrift für Interkulturellen Fremdsprachenunterricht 20: 2, 1-4. Online abrufbar unter http://tujournals.ulb.tu-darmstadt.de/index.php/zif/ [10.04.25].
Name of Module	**Thermodynamics**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS

Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	4
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	English
Use in other Programs	▪ BA Mechanical Engineering ▪ BA Electrical Engineering for Sustainable and Renewable Energy ▪ BA Engineering Physics
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	Students will be able to: ▪ Distinguish between: o State variables o Process variables ▪ Calculate: o Specific gas constants o State variables in the two-phase region o Properties of ideal gases and gas mixtures o Cyclic thermodynamic processes ▪ Understand and apply: o Phase diagrams o The first law of thermodynamics to closed and open systems o The second law of thermodynamics to various systems Students will understand: ▪ Concepts of: o System and state o Processes and process variables ▪ Thermodynamic principles: o First law of thermodynamics

	o Second law of thermodynamics ▪ Behavior of: o Ideal gases and their state variables o Gas mixtures, moist air, and steam ▪ Analysis of: o Phase diagrams o Cyclic processes in power-generating and work-absorbing machines o Selected adabatic flow processes
Content	See Qualification Goals
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

3. Third Study Phase – Semester 5 and 6

Name of Module	**Automatisierungstechnik (Factory Automation)**
Abbreviation	Au2
Form of Teaching / SWS	In-person seminar (1 SWS) and practical work (3 SWS) / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	6
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr.-Ing. Matthäus Brela
Lecturer	Prof. Dr.-Ing. Matthäus Brela
Language of Instruction and Examination	German
Use in other Programs	BA Mechanical Engineering
Formal Requirements	None
Other Requirements	Basic knowledge of data processing, Basic knowledge of PLC technology, Fundamental knowledge in measurement technology
Qualification Goals / Competences	• Students understand the roles of each level in the automation pyramid. • They are aware of the basic differences between process and measurement capability, as well as between acceptance testing and calibration. • They can independently determine process and measurement capability and differentiate between quality assurance, process optimization, and fault diagnosis. • They are capable of determining process capability indices and optimizing them through process simulations. • They are able to design a control system for integrated processes, implement various communication protocols, and analyze and optimize process controls. • They can commission a DC motor, stepper motor, axis objects, and the associated final stages.

	• They can mathematically formulate methods for condition monitoring, select suitable approaches based on practical application scenarios, and develop CM software. • They are capable of naming various protocols within the OSI layer model and subsuming messages in automation technology accordingly. • They understand the role of a process control system (Manufacturing Execution System – MES). • They can explain the basic concept of IEC 1855 and understand synchronization mechanisms in control technology. • They are able to describe the reference architecture model of Industry 4.0. • They can enable communication between processes using OPC-UA and MQTT protocols. •
Content	Automated Production Systems • Degree of automation in production systems, process data, process technology, availability, and Overall Equipment Effectiveness (OEE). Sensors and Actuators • Measurement principles, requirements for testing processes, development of testing processes, and sensor technology. Test Technology and Diagnosis • Computer-aided diagnosis, measurement and process capability, etc. Condition Monitoring • Acquisition and processing of measurement data. Statistical methods for process data analysis: mean value, RMS, crest factor, skewness, kurtosis, Fourier analysis, etc. Communication in Automation Technology • Networks, network topology, network components, OSI layer model, message structure, Ethernet and Industrial Ethernet, transmission methods in fieldbus systems, token passing, TDMA, frame summation methods, synchronization mechanisms, etc. Protocols in Automation Technology • RS232, RS485, TCP/IP, OPC-UA, MQTT, Modbus, EtherCAT, ProfiNet, Profibus, PowerLink, Ethernet/IP, DeviceNet, EnOcean, KNX, LON, DALI, IO-Link, AS-Interface, CANopen, etc. Security • Security mechanisms, certificates, certificate exchange, encryption mechanisms. Laboratory Experiments • Process optimization with PlantSimulation

	• Communication and data exchange: RS232, TCP/IP, OPC-UA, etc. • Process control with Fischertechnik Factory
Grading and Examination Achievements	Practical project work
Additional Assignments	None
Technical Tools	Projector and board/whiteboard, simulation programs, electronic scripts and working materials, practical exercises.
Literature	Vogel-Heuser, B.; Bauernhansl, T.; ten Hompel, M.: Handbook Industry 4.0, 2nd edition, Springer Vieweg, 2017 Goehner, P.: Agent Systems in Automation Technology, 1st edition, Springer Vieweg, 2013 Reinheimer, S. (Ed.): Industry 4.0 – Challenges, Concepts and Practical Examples, 1st edition, Springer Vieweg, 2017 Robert Bosch GmbH (Ed.): Pocket Book for Crafts and Industry, 6th edition, Senner-Druck, Nürtingen, 2017 Seitz, M.: Programmable Logic Controllers for Factory and Process Automation, 4th edition, Carl Hanser Verlag, 2015 Langmann, R.: Pocket Book of Automation, 3rd edition, Carl Hanser Verlag, 2017

Name of Module	**Computermesstechnik (Computer-Based Measurement Technology)**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester	5
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	Prof. Dr. Merhof
Lecturer	Prof. Dr. Merhof
Language of Instruction and Examination	English
Use in other Programs	BA Mechanical Engineering
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	This module provides students with a comprehensive introduction to the principles and practices of computer-integrated measurement and testing systems. The focus lies on the development of software solutions for capturing, processing, and visualizing measurement data in industrial and laboratory environments. Students will acquire the ability to analyze and structure basic measurement tasks and will gain practical experience in designing and implementing software for data acquisition using the Python programming language. Key aspects include signal processing, real-time data handling, and visualization techniques. The course also covers the most relevant hardware interfaces for connecting measurement instruments, such as RS232, GPIB, USB, and LAN. Students will become familiar with access mechanisms, learn how to communicate with instruments using the SCPI command language, and develop the skills to create basic device drivers independently. In addition, the module addresses fundamental concepts of digital measurement data acquisition, including sampling, quantization, and error analysis. Students will be

	able to assess how these factors affect the quality and accuracy of measurement results. An important part of the course is devoted to networked applications. Topics include the ISO/OSI communication model, the TCP/IP protocol stack, local area networks (LAN), and internet-based communication. Students will explore server/client architectures and the challenges involved in the digital transmission and storage of measurement data. Upon successful completion of the module, students will be equipped with the essential competencies to design and implement computer-based measurement systems and understand their integration into modern production and testing environments.
Content	See Qualification Goals
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Industrielle Bildverarbeitung (Industrial Computer Vision)**
Abbreviation	
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	6
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr. Kühnlenz
Lecturer	Prof. Dr. Kühnlenz
Language of Instruction and Examination	German and English
Use in other Programs	BA Mechanical Engineering
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	**Technology of machine vision systems:** • *CCD/CMOS chip technology* • *Fundamentals of color vision* • *Bus systems* **Image processing pipeline:** • Image acquisition • Image enhancement • Segmentation and feature extraction • Edge extraction • Classification • Camera calibration • Stereo reconstruction
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	

Name of Module	**Introduction in Scientific Writing (Level C1.1)**
Abbreviation	
Form of Teaching / SWS	4 SWS
Credits	5 ECTS
Workload	Overall workload: 120 hours, comprising ▪ 45 contact hours ▪ 75 hours self-study
Semester	6
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German
Use in other Programs	n/a
Formal Requirements	Technical German 3 (Level B2.2)
Other Requirements	n/a
Qualification Goals / Competences	**Language Proficiency C1.1** **Spoken interaction** o *Can discuss the results of their analysis of a technical text* o *Can define technical terms and build argumentation structures appropriate to the target audience.* o *Can present a complex topic in an appropriate, clear and well-structured way, prioritising the most important points* **Reading Comprehension** o *Can understand long and complex instructions or directions that go beyond own field of specialisation or interest when difficult sections are read several times* o *Can analyse the subject-specific nature of relevant genres and conventions of scientific writing in technical texts.* o *Can understand detailed scientific reports, analyses and commentaries in which contexts, opinions and points of view are discussed* **Written production**

	○ *Can write about complex technical issues through the textual combination of language and image in technical contexts.* ○ *Can refer to arguments from the research literature (various sources) in their own scientific text and weigh them up against each other* ○ *Can present his/her own point of view on a research topic, highlighting main ideas and use examples to give reasons for his/her arguments.*
Content	▪ Specialised academic writing conventions: Reflection on the content, structure and style of academic texts as well as formal aspects (citation, illustrations and layout). ▪ Writing and reading strategies: teaching effective strategies for academic writing and reading. ▪ Planning the thesis: support in planning the Bachelor's thesis, including objectives, choice of methods, self-control and time management. ▪ Reflection on writing processes: Guidance on reflecting on individual writing processes and strategies in groups. ▪ Practical exercises: Carrying out practical exercises to apply the writing techniques and strategies learnt.
Grading and Examination Achievements	written exam and practical work
Additional Assignments	**Learning material:** Subject-specific learning materials will be provided in the course.
Technical Tools	Notebook, Tablet, Headphones
Literature	18. Bräuer, Gerd. 2023. Literacy Management als Schlüsselkompetenz in einer digitalisierten Welt: Ein Arbeitsbuch für Schreibende, Lehrende und Studierende. Opladen, Berlin, Toronto: Barbara Budrich. 19. Council of Europe: Global scale - Table 1 (CEFR 3.3): Common Reference levels (coe.int) Council of Europe: Official translations of the CEFR Global Scale (coe.int) [03.04.25] 20. Gemeinsamer Europäischer Referenzrahmen für Sprachen: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] 21. Glaboniat, M.; Müller, M.;Rusch, P.; Schmitz, Helen; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4. 22. Graßmann, Regina. 2021. Fachintegrierte Schreiblehre in den angewandten Wissenschaften. Das Modell Interdisciplinary Academic Literacies. In: trans-kom Band 14, Nummer [1] (2021) [10.04.25].

Name of Module	**Motion Control**
Abbreviation	MoCo
Form of Teaching / SWS	In-person seminar, exercise and practical work / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	6
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr.-Ing. Matthäus Brela
Lecturer	Prof. Dr.-Ing. Matthäus Brela
Language of Instruction and Examination	German
Use in other Programs	BA Mechanical Engineering
Formal Requirements	None
Other Requirements	Physical laws of translational and rotational motions, basic knowledge of PLC technology and programming languages, basic knowledge of measurement and control technology.
Qualification Goals / Competences	• The students are able to analyze technical motion processes and describe them mathematically. • They are able to reproduce the architecture of motion control and describe the basic design criteria. • They are familiar with the common mechanical devices for executing one-dimensional motion processes and can differentiate between various positioning tasks. • They know the fundamental kinematic relationships of mechanically uncoupled and mechanically coupled motion axes and can express positions and speeds in different reference systems. • They are capable of designing position, angle, and acceleration measurement systems for motion control. • They can describe the problem of EMC and are able to calculate the resulting errors in performance. • They know the tasks of synchronization and interpolation of motion axes and the common methods and concepts used for these purposes.

	• They can analyze the power flow along a positioning axis and dynamically design simple drive systems. • They understand the concept of cascade control for motion guidance. • They know the mathematical fundamentals of machine dynamics and can apply them. • They understand the operation of the motion control blocks according to PLCopen and can program simple positioning tasks using these blocks.
Content	• Kinematic Relationships Basic description of rotational and translational motion processes, one-dimensional positioning processes, synchronous movements of mechanically uncoupled axes, two-dimensional motion processes using open or closed kinematic chains, reference coordinate systems and coordinate transformations, three-dimensional positioning and orientation movements in space through the combination of motion axes. • Dynamic Relationships Power flow and four-quadrant operation, force and torque conversion, masses and moments of inertia, vibrational dynamics. • Control System Relationships Current and torque control, speed control, position control. • Sensor Measurement Principles for Motion Automation Relative/Absolute, position sensors, rotational speed and speed sensors, acceleration sensors, force and torque sensors. • Diagnostic Systems and Safety Motor data, service data, diagnostic data, scope monitoring, safety functions. • Drive Control Design, commissioning, and control of a stepper motor; design, commissioning, and control of a servo motor. • Motion Control Blocks according to PLCopen MC-MoveAbsolute, MC-Power, MC-MoveRelative, MC-MoveJog, MC-CamIn, MC-MoveVelocity, and other basic MC blocks. • Laboratory Experiments Basic positioning processes, interpolation of axis movements, and synchronization of mechanically independent axes.
Grading and Examination Achievements	Written exam (90 minutes) and practical performance record (3:1)
Additional Assignments	None

Technical Tools	Projector and board/whiteboard, simulation programs, electronic scripts and working materials, practical exercises.
Literature	Kiel E.: Antriebslösungen – Mechatronik für Produktion und Logistik Springer 2007 Groß, Hamann u.a.: Technik elektrischer Vorschubantriebe in der Fertigungs- und Automatisierungstechnik, Publicus Corporate Publishing 2012 Heimann, B. u.a.: Mechatronik: Komponenten-Methoden-Beispiele Carl Hanser 2007 Weidauer, Jens, Elektrische Antriebstechnik, Grundlagen – Auslegung – Anwendungen – Lösungen. Publicis Corporate Publishing 2008 Weck, M. u.a., Werkzeugmaschinen 3 – Mechatronische Systeme, Vorschubantriebe, Prozessdiagnose. Springer Vieweg Verlag, 2006 Reif, K.: Sensoren im Kraftfahrzeug, 3. Auflage, Springer Vieweg Verlag, 2016 Brosch, P. F.: Taschenbuch der Antriebstechnik - Messsysteme für E-Antriebe, Carl Hanser Verlag, 2014

Name of Module	**Robotik (Robotics)**
Abbreviation	Ro
Form of Teaching / SWS	In-person / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	5
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	Prof. Dr. Kühnlenz
Lecturer	Prof. Dr. Kühnlenz
Language of Instruction and Examination	English
Use in other Programs	BA Mechanical Engineering
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	**Robot kinematics:** • *Homogeneous transformations* • *Direct and inverse kinematics* • *Jacobian-methods* • *Singularities* **Robot dynamics:** • Lagrangian dynamics • Computed torque **Path planning** • *Graph- and cell-based approaches* **Robot control** • *Position and trajectory control* • *Computed torque*
Grading and Examination Achievements	Written exam

Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Signale und Systeme (Signals and Systems)**
Abbreviation	SuS
Form of Teaching / SWS	In-person seminar (3 SWS) and practice (1 SWS) / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	5
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	Prof. Dr. Mörz
Lecturer	Prof. Dr. Mörz
Language of Instruction and Examination	German
Use in other Programs	BA Mechanical Engineering
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	**After the course, students will be able to** - explain and evaluate the basic properties of signals and systems - describe and calculate linear time-invariant (LTI) systems in their continuous-time representation (linear differential equations, convolution operation, convolution integral) - describe and calculate continuous LTI systems in the frequency domain (Fourier transform) - describe and calculate continuous LTI systems in the image domain (Laplace transform) - explain the sampling operation and its significance in the time and frequency domain - Describe and calculate linear time-invariant (LTI) systems in their discrete-time representation (z-transform)
Content	• - Transition to normalized signals • - Continuous-time elementary signals • - Linear time-invariant (LTI) systems - continuous-time • - System description with linear differential equations • - Impulse, step and ramp response of LTI systems • - Convolution operation • - System description using the Laplace transform • - Transfer function

	• - Block diagram algebra • - Frequency response and Bode diagram • - Frequency responses of elementary systems (P, I, D, PT1, PD, DT1) • - Sampling (time and frequency domain) • - Linear time-invariant (LTI) systems - discrete-time • - elementary (discrete-time) signal sequences • - Step and impulse response • - Discrete-time convolution • - Z-transformation
Grading and Examination Achievements	Written exam
Additional Assignments	
Technical Tools	Projector, presentation slides, blackboard/whiteboard, course materials in electronic form, use of an e-learning system, mathematical application software
Literature	

Name of Module	**Seminar Automation und Robotik (Seminar Automation and Robotics)**
Abbreviation	
Form of Teaching / SWS	In-person seminar / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 30 contact hours ▪ 120 hours self-study
Semester	6
Recurrence	Once a year in summer semester
Duration	One semester
Module Responsibility	Prof. Dr. Kühnlenz
Lecturer	Profs of the Faculty
Language of Instruction and Examination	German and English
Use in other Programs	BA Mechanical Engineering
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	Participants have the necessary methodological and interdisciplinary skills to independently prepare scientific seminar papers on more demanding topics in engineering and related fields. They can work with scientific literature (e.g. research, categorize, prioritize, cite), critically evaluate the sources and present them in writing to a specialist audience.
Content	Participants work independently on a seminar paper on more demanding scientific topic from basic areas or on the state of the art in research and technology. The paper summarizes and discusses the essential aspects of the topic and provides an overview of sources. At the beginning of the course, each participant is given a scientific topic. They will prepare a written paper using literature they have researched themselves. Before the start of the seminar, the respective lecturer will announce how the individual performances will be weighted to determine the grade. The lecturers support the students in learning technical and scientific skills. The seminar also prepares students methodically for their Bachelor's thesis, in the context of which their own contribution must also be regularly embedded in the existing state of research and technology.

Grading and Examination Achievements	Seminar Paper
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Softwareentwurf in der Automatisierungstechnik (Software Development in Automation)**
Abbreviation	SwAu
Form of Teaching / SWS	In-person seminar, exercise and practical work / 4 SWS
Credits	5 ECTS
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study
Semester	5
Recurrence	Once a year in winter semester
Duration	One semester
Module Reponsibility	Prof. Dr.-Ing. Matthäus Brela
Lecturer	Prof. Dr.-Ing. Matthäus Brela
Language of Instruction and Examination	German
Use in other Programs	▪ BA Automatisierungstechnik und Robotik ▪ BA Elektro- und Informationstechnik ▪ BA Energietechnik und Erneuerbare Energien ▪ BA Informatik
Formal Requirements	None
Other Requirements	Basics of digital technology, automata theory, state graphs, control and regulation technology, knowledge of a high-level programming language
Qualification Goals / Competences	• Students should become familiar with the methods and programming techniques of industrial control technology and be able to independently solve simple automation tasks in the various programming languages of IEC 61131. • Students are able to structure a control program, apply UML modeling languages, program in an object-oriented manner, write reusable code, create libraries, and debug programming errors. • Familiarity with serial data communication in automation technology and planning of bus communication. • Familiarity with the human-machine interface and the methods for planning and creating operating interfaces for industrial controllers.
Content	Control Technology • Configuration of controllers, communication in automation technology, fieldbus systems, distributed systems according to IEC 61499, programming methods according to IEC 61131-3 in Structured Text. Design of Visualizations

	• Operation and monitoring, visualization elements, element linking, control via visualizations, supervision, analysis, creation of simple operating interfaces. Software Design • V-Model, use of process language for sequential programming, creation of class diagrams and their application, creation of state diagrams and their application. Object-Oriented Programming • Structure, design and programming of classes, use of objects, encapsulation, inheritance, derivation, access modifications, constructors, destructors, properties, references, interfaces, virtual and abstract methods, recipe management. Reusability • Creation of libraries, error handling, use of pragmas, programming guidelines Laboratory: • Communication (protocols), gripper control (visualization), gripper control (sequence control), operating states (state diagram), object-oriented programming (class diagram), libraries (interface), commissioning.
Grading and Examination Achievments	Written exam (90 minutes) and practical performance record (3:1)
Additional Assignments	None
Technical Tools	Projector and board/whiteboard, simulation programs, electronic scripts and working materials, practical exercises.
Literature	Günther Wellenreuther / Dieter Zastrow: Automating with PLC, Vieweg Verlag Wiesbaden, 4th edition 2008, EAN 978-3-8348-0231-6 Karl-Heinz John, Michael Tiegelkamp: PLC Programming with IEC 61131-3, Concepts and Programming Languages, Requirements for Programming Systems, Decision Aids. VDI Book, Springer-Verlag, 4th edition 2009, EAN 978-3-6420-0268-7 Eberhardt Grötsch: PLC – Programmable Logic Controllers, Oldenbourg Verlag München, 5th edition 2004, EAN 978-3-8356-7043-3 Raimond Pigan, Mark Metter (graduate of our faculty): Automating with PROFINET: Industrial Communication Based on Industrial Ethernet, Publicis Corporate Publishing Erlangen, 2nd edition 2008 Michael Braun: Object-Oriented Programming, Basics, Programming Examples and Software Concept according to IEC 61131-3, Publicis Pixelpark Erlangen, 2016, ISBN 978-3-89578-455-2. PLCopen: www.plcopen.org as well as other books and URL links

Name of Module	**Technical German 3 (Level B2.2)**
Abbreviation	
Form of Teaching / SWS	4 SWS
Credits	5 ECTS
Workload	Overall workload: 120 hours, comprising ▪ 45 contact hours ▪ 75 hours self-study
Semester	5
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German
Use in other Programs	BA Digital Business Models and Technologies
Formal Requirements	Students are only permitted to enter the fifth semester (third stage of study) if they have completed the German Basics 3 (Level B1.1) modules in accordance with the annex to the study and examination requirements.
Other Requirements	n/a
Qualification Goals / Competences	**Language Proficiency B2.2 (Independent User, CEFR)** **Spoken interaction** o *Can understand key information in presentations, lectures and brief discourses on well-known topics in his/her field of specialisation or interest.* o *Can give a short report on a selected specialised topic.* o *Can actively contribute to formal discussions by giving arguments for his/her own point of view and commenting on comments made by others.* **Reading Comprehension** o *Can understand and compare sources of information and arguments in scientific texts.* o *Can understand a specific procedure on the basis of a diagram.*

	○ *Can quickly find key details in long and complex general and specialised texts.* **Written production** ○ *Can write address-oriented, clearly structured texts on a complex topic and summarise the most important points in them.* ○ *Can can formulate descriptive titles (e.g. for a presentation)* ○ Can write a summary of articles and reports on specialised topics of general interest.
Content	Students acquire linguistic and cultural competences (reading, listening, writing and speaking skills) for everyday life and study in German. German is usually the second, third or additional language English. It is of central importance for multilingual learners to recognise the language as a system (language comparison). In this way, they develop a deeper understanding of linguistic structures (grammar, lexis) and the cultural context, which improves their ability to communicate independently in everyday life. – This course is based on the CLIL model.
Grading and Examination Achievements	Written exam (90-120 minutes)
Additional Assignments	**Learning material:** Subject-specific learning materials will be provided in the course.
Technical Tools	Notebook, Tablet, Headphones
Literature	23. Council of Europe: Global scale - Table 1 (CEFR 3.3): Common Reference levels (coe.int) Council of Europe: Official translations of the CEFR Global Scale (coe.int) [03.04.25] 24. Gemeinsamer Europäischer Referenzrahmen für Sprachen: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] 25. Glaboniat, M.; Müller, M.;Rusch, P.; Schmitz, Helen; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4. 26. Heine, L.. 2015. „Lernziele“. In: Zeitschrift für Interkulturellen Fremdsprachenunterricht 20: 2, 15-20. Online abrufbar unter http://tujournals.ulb.tu-darmstadt.de/index.php/zif/ [10.04.25]. 27. Lindemann, B. 2015. In: Zeitschrift für Interkulturellen Fremdsprachenunterricht 20: 2, 1-4. Online abrufbar unter http://tujournals.ulb.tu-darmstadt.de/index.php/zif/ [10.04.25].

4. Industrial Internship – Semester 7

Name of Module	**Industrial Internship**
Abbreviation	
Form of Teaching / SWS	
Credits	25 ECTS
Workload	Overall workload: 20 weeks full time work in a company
Semester	7
Recurrence	Each semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German or English
Use in other Programs	
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	Application of theoretical knowledge to questions and topics in professional practice; the professional focus should be chosen according to the personal area of specialisation; possible areas are e.g. development, design, project planning, production, production preparation and control, quality management, optimisation of technical processes.
Grading and Examination Achievements	Practical report
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Industrial Internship – Accompaying Seminar 1**
Abbreviation	
Form of Teaching / SWS	In-person seminar / 3 SWS
Credits	3 ECTS
Workload	Overall workload: 112.5 hours, comprising ▪ 37.5 contact hours ▪ 75 hours self-study
Semester	7
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German or English
Use in other Programs	
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	The seminar deals with introduction to scientific work, organization of literature research, and ability to process information. Identification of topics and learning fields literature research, literature procurement, information preparation, presentations, practical report, Bachelor's thesis
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Industrial Internship – Accompaying Seminar 2**
Abbreviation	
Form of Teaching / SWS	In-person seminar/ 2 SWS
Credits	2 ECTS
Workload	Overall workload: 75 hours, comprising ▪ 22.5 contact hours ▪ 52.5 hours self-study
Semester	7
Recurrence	Once a year in winter semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German or English
Use in other Programs	
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	The seminar deals with project management: basic project management methods and their application, consistent planning and work on projects in a team, collaboration skills and working techniques, social skills. From the idea to the clarified assignment, project influences, roles in project management, cooperation in projects, visions and goals, procedure and milestones, overview of all project tasks, planning and controlling of projects, risk management, structure and preparation, classic PM and agile project management.
Grading and Examination Achievements	
Additional Assignments	
Technical Tools	
Literature	

5. Final Thesis - Semester 8

Name of Module	**Bachelor Colloquium**
Abbreviation	
Form of Teaching / SWS	
Credits	3 ECTS
Workload	Overall workload: 90 hours
Semester	8
Recurrence	Each semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German or English
Use in other Programs	
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	In the Bachelor Colloquium, the motivation and the main results of the Bachelor thesis are summarized and presented. The presentation serves to defend your own work and answer questions from experts and the audience. This shows that you have understood the topic well and are able to explain and discuss it. You receive valuable feedback that can be used to improve your work or for future projects. ▪ Summary of engineering and scientific results ▪ Designing and structuring a presentation, using suitable media ▪ Rhetoric in a professional context ▪ Discussion of scientific methods and expert knowledge
Grading and Examination Achievements	Presentation
Additional Assignments	

Technical Tools	
Literature	

Name of Module	**Bachelor Thesis**
Abbreviation	
Form of Teaching / SWS	
Credits	12 ECTS
Workload	Overall workload: 360 hours (project work)
Semester	8
Recurrence	Each semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German or English
Use in other Programs	
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	Professional and methodological objectives: The student is able to independently work on or solve a complex task from their degree program on a scientific basis.
Content	As part of the Bachelor's thesis, students usually work on an engineering problem in a company. There are a wide range of topics to choose from in the areas of development, design, modeling and simulation, testing, production and logistics, etc. The project is accompanied and supervised by a member of staff and a professor at the university.
Grading and Examination Achievements	Bachelor Thesis
Additional Assignments	
Technical Tools	
Literature	

Name of Module	**Engineering Project**
Abbreviation	
Form of Teaching / SWS	
Credits	5 ECTS
Workload	Overall workload: 300 hours
Semester	8
Recurrence	Each semester
Duration	One semester
Module Responsibility	N.N.
Lecturer	N.N.
Language of Instruction and Examination	German or English
Use in other Programs	
Formal Requirements	
Other Requirements	
Qualification Goals / Competences	
Content	The practical engineering project serves as a supplement to the Bachelor's thesis. Specialist knowledge and scientific methods are deepened. Usually, a topic related or interlinked with the Bachelor's thesis is worked on in the relevant company. ▪ Project organization and structuring ▪ Literature research ▪ Methodical knowledge acquisition ▪ Scientific evaluation and documentation
Grading and Examination Achievements	Scientific Report
Additional Assignments	
Technical Tools	
Literature	