COBURG UNIVERSITY
of applied sciences and arts

MODULE MANUAL

Automation and Robotics (B.Eng.)

Valid für Study and examination regulations (SPO) 2025
01-09-2026

1. ABBREVATIONS

B.Eng.	Bachelor of Engineering
ECTS	European Credit Transfer System
S	Summer semester
SWS	Contact hours per week
W	Winter semester

2. PROFILE OF THE BACHELOR´S PROGRAM

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.

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<tr><th colspan="31">Curriculum of Automation and Robotics</th></tr>
<tr><td>ECTS</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td></tr>
<tr><td>1W</td><td colspan="5">Introduction to Advanced Mathematics</td><td colspan="5">Scientific Basics</td><td colspan="3">Soft Skills and Culture</td><td colspan="5">Academic English Skills</td><td colspan="5">German Basics 1 (Level A1)</td><td colspan="7">German Basics 2 (Level A2)</td></tr>
<tr><td>2S</td><td colspan="5">Technical Mathematics 1</td><td colspan="5">Mechanics 1</td><td colspan="5">Measurement Technology</td><td colspan="5">Fundamentals of Electrical Engineering</td><td colspan="5">Programming</td><td colspan="5">German Basics 3 (Level B1.2)</td></tr>
<tr><td>3W</td><td colspan="5">Technical Mathematics 2</td><td colspan="5">Mechanics 2</td><td colspan="5">Fluid Mechanics</td><td colspan="5">Fundamentals of Business Administration</td><td colspan="5">Fundamentals of Computer based Measurement</td><td colspan="5">Technical German 1 (Level B1.2)</td></tr>
<tr><td>4S</td><td colspan="5">Technical Mathematics 3</td><td colspan="5">Mathematical Applications</td><td colspan="5">Thermodynamics</td><td colspan="5">Control Systems</td><td colspan="5">Electrical Drives, Power Grids and Safety</td><td colspan="5">Technical German 2 (Level B2.1)</td></tr>
<tr><td colspan="31">Content Integrated Language Learning</td></tr>
<tr><td>5W</td><td colspan="5">Computermesstechnik (Computer based Measurement Technology)</td><td colspan="5">Softwareentwurf in der Automatisierungstechnik (Software Development in Automation)</td><td colspan="5">Robotik (Robotics)</td><td colspan="5">Signale und Systeme (Signals and Systems)</td><td colspan="5">Wahlpflichtfach 1 (Elective Subject 1)</td><td colspan="5">Technical German 3 (Level B2.2)</td></tr>
<tr><td>6S</td><td colspan="5">Automatisierungstechnik (Factory Automation)</td><td colspan="5">Motion Control</td><td colspan="5">Seminar Automatisierungstechnik und Robotik (Seminar Automation and Robotics)</td><td colspan="5">Industrielle Bildverarbeitung (Industrial Image Processing)</td><td colspan="5">Wahlpflichtfach 2 (Elective Subject 2)</td><td colspan="5">Introduction in Scientific Writing (Level C1.1)</td></tr>
<tr><td>7W</td><td colspan="25">Industriepraktikum (Industrial Internship)</td><td colspan="5">(Block) Seminars accompanying Internship</td></tr>
<tr><td>8S</td><td colspan="12">Bachelor Thesis</td><td colspan="3">Bachelor Colloquium</td><td colspan="10">Engineering Project</td><td colspan="5">Wahlpflichtfach 3 (Elective Subject3)</td></tr>
</table>

Language Learning

4. RISK ASSESSMENT

Each module description contains a risk assessment in accordance with the Maternity Protection Act (§ 10ff MuschG). It states whether there are any potential risks to the unborn or the breastfed child of a student if she participates in the course. The assessment of the risk potentials is carried out by the module coordinator.

Green	compliant, no restrictions
Yellow	requires individual assessment
Red	participation is not permitted during pregnancy and breastfeeding.

- *Chart 1: Risk assessment in accordance with the Maternity Protection Act*

For further information and advice please contact the universities family office.

5. MODULE DESCRIPTIONS

The following module descriptions are valid for the Study and examination regulations (SPO) 2025. They will be updated before start of the term, if concept, content, or examination have been changed.

First theoretical Study Phase – Semester 1

Introduction to Advanced Mathematics (IAM)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Higher mathematics includes arithmetic operations and analytical methods that go beyond the school basics. In addition to the number range of rational numbers, the range of real and complex numbers is also used. Special mathematical functions such as powers, roots, logarithms and angle functions are also required. When describing technical and scientific systems, different equations arise which require special solution algorithms depending on the type of possible non-linearity. Finally, the laws and formulas for plane figures and spatial solids as well as an understanding of the Cartesian coordinate system are also part of the foundations of advanced mathematics.		
Instructor responsible for module	Prof. Dr. Alexander Stadler		
Lecturer	Prof. Dr. Alexander Stadler Carlo Höhn (M.Eng.)		
Language of instruction and examination	**Use in other study programs**		
English	B.Eng. Mechanical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
1st semester 1st theoretical study phase	Compulsory module	One semester	Once a year in winter semester
WORK AND EXAM PERFORMANCE			
Participation requirements	None		
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	0,5		
Workload	Overall workload: 150 hours, comprising • 45 hours online lectures • 105 hours self-study		
Contact hours per week (SWS)	4		
Risk assessment for pregnant women and mothers	Green		

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar, seminar-based teaching, exercise 2 SWS Lectures 2 SWS Exercises / Revisions	Written exam (60-90 min.)	

CONTENT, METHODS AND RESULTS

Course 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

Learning outcomes

After attending this module, students are aware of fundamental mathematical structures and methods. Students are able to understand the basic concepts of linear algebra and geometry, like vectors, and calculus (e.g. real functions, differential and integral calculus) and are able to apply them to basic problems in science and technics.

Teaching and learning methods

The module consists of a series of learning lectures. In these lectures, theoretical principles and exercises are presented. For the presentation of results and the illustration of graphics, the programming language Octave (GNU public license) is used. A short introduction is also part of this course.

Reading list
▪ I. N. Bronstein, H. Mühlig, G. Musiol, K. A. Semendjajew, Taschenbuch der Mathematik, Verlag Europa-Lehrmittel, 11. Auflage, 2020, ISBN-10: 3808557923 ▪ A. M. Haghighi, A. A. Kumar, D. P. Mishev, Higher Mathematics for Science and Engineering, Springer, 1st Edition, 2025, ISBN-10: 9819954339 ▪ E. Kreyszig, Advanced Engineering Mathematics, International Adaptation, Wiley, 11th Edition, 2025, ISBN-10: 1394319460 ▪ G. Merzinger, T. Wirth, Repetitorium Höhere Mathematik, Carl Hanser Fachbuchverlag, 7. Auflage, 2024, ISBN-10: 3446482334 ▪ K. A. Stroud, D. J. Booth, Engineering Mathematics, Bloomsbury Academic, 8th Edition, 2020, ISBN-10: 1352010275

Scientific Basics (SB)

(Automation and Robotics, B.Eng., SPO 2025), B.Eng., SPO 2025)

Summary	Nature is described with the help of physical quantities. Their properties are observed and analyzed in experiments and relationships between the variables are investigated. An understanding of the structure of matter, its states of aggregation and changes in state and substance is fundamental to the interpretation of physical and chemical processes. In summary, Scientific Basics contains some fundamental features of our physical world view as well as an insight into the field of inorganic chemistry.
Instructor responsible for module	Prof. Dr. Martin Prechtl
Lecturer	Prof. Dr. Martin Prechtl Dr. Klaus Horbaschek Christian Wolf
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Mechanical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
1st semester 1st theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE

Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,5
Workload	Overall workload: 150 hours, comprising ▪ 45 hours online lectures ▪ 105 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green The courses pose no risks to pregnant women or mothers.

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar, seminar-based teaching, exercise 2 SWS Lectures, partially virtual laboratory tour 2 SWS Exercise / Revision	6 short online midterm tests (each 15 min.) and written exam at the end of the semester (60-90 min.)	Basic scientific calculator

CONTENT, METHODS AND RESULTS

Course content

Physical quantities and their units (Prof. Dr. M. Prechtl)

- Types of description of objects and processes, the International System of Units
- Definition of selected physical quantities, ▪ Physical constants of nature
- Dealing with very small / large values, prefixes

Basics of experimentation (Lecturer Chr. Wolf)

- Planning and conducting experiments
- Observation and data collection
- Measurement error and accuracy, evaluation, conclusion and documentation

The Structure of atoms (Prof. Dr. M. Prechtl)

- Structure of atomic nuclei und nuclear reactions, The Bohr's atomic model energy levels
- Basics of quantum mechanics, atomistic interpretation of physical effects

Chemical and physical bonding (Dr. K. Horbaschek)

- Types of chemical bonds: Ionic, metallic and covalent bond, electronegativity and bond polarity
- Nomenclature of binary compounds, the octet rule and its many exceptions
- Structure of chemical compounds
- The van der Waals interaction, hydrogen bondEnergetically stable atoms and the octet rule

The states of matter (Dr. K. Horbaschek)

- 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 (Dr. K. Horbaschek)

- Types of chemical reactions, e.g. acid-base, redox, complexation, metathesis
- Reaction equation, law of conservation of mass, stoichiometry of chemical reactions
- Exothermic and endothermic reactions, chemical equilibria, e.b. acid base equilibria, solubility product

Learning outcomes
Skills in Fundamentals of Physics: Students understand the basic structure of matter and can use this knowledge to explain simple processes and effects in nature and technology. They are able to de-scribe observations qualitatively and quantitatively. In addition, students can handle small and large values and have a sense of the magnitude of values. Chemical Competencies: Students are able to use chemical nomenclature correctly. They are able to describe basic relationships between structure and chemical and physical properties of chemical compounds. Students are able to solve basic quantitative problems. Execution of Experiments and Documentation: Students will be able to systematically conduct experiments, accurately record measurement data, and document procedures and results in a clear and standardized format. Data Analysis and Interpretation: Students will be able to analyze experimental data using funda-mental statistical methods, quantify uncertainties, and critically evaluate the significance and limitations of their results.
Teaching and learning methods
Flipped classroom: Students study theoretical content (e.g. videos, readings) before class. Live ses-sions are used for discussions, applications, and problem-solving. Concept Checks: Short, targeted questions used during class to assess students’ understanding of key concepts and uncover misconceptions. Live polling: Interactive tools are used in real time to collect student responses, visualize results, and stimulate discussion.
Reading list
Literature for physics: ▪ W. Demptröder: Nuclear and Particle Physics. Springer Nature Switzerland, 2023 ▪ G.L. Squires: Practical Physics. Cambridge University Press, 2003 ▪ J.P.Holman: Experimental methods for Engineers. McGraw-Hill Book, 2001 Literature for chemistry: ▪ T. Brown: Chemistry - The Central Science in SI Units. Person Education, 2021

Academic English Skills (AES)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The "Academic English Skills" module teaches the essential language and methodological skills for everyday academic life. It includes academic writing and reading, the targeted development of a subject-specific vocabulary and the improvement of grammatical and stylistic skills. In addition, oral communication skills, research techniques and critical thinking are trained so that students are optimally prepared for scientific challenges. The targeted language level is at the CEFR B2.2.
Instructor responsible for module	Barney Craven
Lecturer	Barney Craven Helen Bulluck
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Automation and Robotics B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
1st semester 1st theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE	
Participation requirements	minimum English language skills at the CEFR B2.1 level
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,25
Workload	Overall workload: 150 hours, comprising: ▪ 15 hours online lecture course ▪ 45 hours online tutorial course ▪ 90 hours self-study
Contact hours per week (SWS)	4
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar, seminar-based teaching, exercise Lecture course (1 SWS) Tutorial course (3 SWS)	Written exam (60-90 min.)	None

CONTENT, METHODS AND RESULTS
Course 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 in order 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.
Learning outcomes
General Competence: Active and passive language skills (speaking, listening comprehension, reading and writing) at the CEFR 2 level or higher ▪ subject-specific focus – technical vocabulary ▪ professional and academic focus – meeting and interviewing skills, presentation techniques, correspondence, reports, academic texts Methodological competence ▪ Acquisition of learning strategies that enable autonomous learning; certain tasks enable reflection on the strategies used Intercultural competence ▪ Use of appropriate language (e.g. registers, forms of politeness) in intercultural interactions in professional and social situations ▪ knowledge of English-speaking countries
Teaching and learning methods
Synchronous lectures, synchronous interactive work, independent learning, Flipped classroom, problem-based learning, role plays and simulation, peer learning

Reading list
Material will be provided in Moodle.

Soft Skills and Culture (SKC)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Trainings in soft skills and basic knowledge of German culture are essential for integration in local society and working culture.		
Instructor responsible for module	2 SWS		
Lecturer	Katja Zimmer, M.A.		
Language of instruction and examination	**Use in other study programs**		
English	B.Eng. Mechanical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
1st semester 1st theoretical study phase	Compulsory module	One semester	Once a year in winter semester
WORK AND EXAM PERFORMANCE			
Participation requirements	None		
ECTS-Credits	3 ECTS		
Factor of calculation towards degree grade	0,25		
Workload	Overall workload: 90 hours, comprising ▪ 20 hours online lecture ▪ 40 hours self-study ▪ 30 hours attended event (blocked in Coburg and surroundings)		
Contact hours per week (SWS)	2		
Risk assessment for preg-nant women and mothers	Green		
Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**	
Seminar-based teaching, exercise 2 SWS	Portfolio	None	

CONTENT, METHODS AND RESULTS
Course content
Historical context from Middle Ages to Germany today: Focus on German identity in the 21st century which will offer an understanding of German history, politics, culture and society today. ▪ World War II and overview on German history after WW II ▪ The End of the Cold War: A New National Identity? ▪ Aspects of Modern German Life: Reunification and immigration ▪ Contemporary Challenges and Trends, Political system and its main consequences. Cultural awareness and cross-cultural communications: Understanding the German/European mindset, Dealing with cultural differences and raising of culture awareness ▪ culture models, learning traditions, communication styles ▪ working together and the German work culture: intercultural communication in business, risks and opportunities in international teams and special features of intercultural cooperation Culture shock: Some typical German customs Studying in Germany: Understanding German Academic Culture ▪ Learning traditions: how to raise independent learning, conditions for successful learning Excursions to the Coburg area and its neighbors.
Learning outcomes
▪ Historical Understanding: Contemporary German Society and Politics: Describe the structure of the German political system; identify contemporary challenges facing Germany, including immigration and social integration. ▪ Cultural Competence and Intercultural Communication: Recognize and interpret cultural differences using established cultural models. Demonstrate an understanding of the German/European mindset and customs, apply intercultural communication skills in academic and professional contexts ▪ Academic Culture and Study Skills: Understand the structure and expectations of German academic institutions; reflect on your own study style, practice independent learning strategies and adapt to German learning traditions. ▪ Experiential and Local Learning: Engage with German culture and history through excursions in the Coburg area and surrounding regions, reflect on direct experiences to deepen understanding of regional identity and local traditions.
Teaching and learning methods
Active learning method: critical incidents and role plays, group work; Experiential learning; Reflective Journals Synchronous Online Teaching and Asynchronous Learning
Reading list
▪ Hofstede, G. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. Online Readings in Psychology and Culture, 2(1). https://doi.org/10.9707/2307-0919.1014 ▪ recent articles on Germany’s contemporary situation from different sources ▪ Literature based on participants’ cultural background

German Basics 1, Level A1 (GB 1)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The German Basics 1 (Level 1) course is designed for international students with little or no previous knowledge of German. The aim is to build up basic knowledge that will enable students to participate for the communication in every day and academic scenarios (oral/written) from the start of the programme. The course content is tailored to the needs of the target group (e.g. internship). These are … ▪ practice-oriented learning objectives (aligned by typical language/writing activities) ▪ Basic vocabulary ▪ Written communication: text type specific structures ▪ Teaching learning strategies to enable autonomous learning ▪ Use of authentic material The focus is on everyday communication in studies and work, (lexis and grammar follow this content (form follows content/function)
Instructor responsible for module	Dr. Edgar Skvotsov
Lecturer	Dr. Edgar Skvotsov
Language of instruction and examination	**Use in other study programs**
German and English	B.Eng. Mechanical Engineering B.Eng. Digital Business Models and Technologies B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
1st semester 1st theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE	
Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,25
Workload	Overall workload: 180 hours, comprising 67,5 contact hours and 112,5 hours self-study
Contact hours per week (SWS)	6

Risk assessment for preg-nant women and mothers	Green	
Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 6 SWS	Written exam (90 min.)	Headphones

CONTENT, METHODS AND RESULTS

Course 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.

Learning outcomes

Language Proficiency A1

Spoken interaction

▪ Can describe simple aspects of daily life in a sequence of simple sentences, using simple words and elementary phrases where preparation is possible.

▪ Can describe him/herself (name, age, family) usind simple words and formulaic expressions where preparation is possible.

▪ 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).

Teaching and learning methods
German Online Training according to the Common European Framework of Reference (CEFR) will enable to move up an entire language level (A1). The training focuses on listening skills, reading and spoken skills. The materials are e.g. audio files, reading texts, videos and cloze exercises. The course is divided into lessons (learning platform Moodle) that teach the vocabulary and grammar to practice basic scenarios in daily life.
Reading list
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; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4. 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.

German Basics 2, Level A2 (GB 2)

(Automation and Robotics, B.Eng., SPO 2025)

<table>
<tr><td>Summary</td><td colspan="3">The German Basics 2 (Level 2) course is designed for international students with elementary German language skills (Level A1). The aim is to enlarge their repertoire of linguistic and cultural competences that will enable students to participate in every day and academic scenarios (oral/written) and to identify and compare core aspects of German culture and society. The course content is tailored to the needs of the target group (e.g. internship).
These are ...
▪ practice-oriented learning objectives (aligned by typical language/writing activities)
▪ Basic vocabulary
▪ Written communication: text type specific structures
▪ Teaching learning strategies to enable autonomous learning
▪ Use of authentic material
The focus is on everyday communication in studies and work, (lexis and grammar follow this content (form follows content/function)</td></tr>
<tr><td>Instructor responsible for module</td><td colspan="3">Dr. Edgar Skvotsov</td></tr>
<tr><td>Lecturer</td><td colspan="3">Dr. Edgar Skvotsov</td></tr>
<tr><td>Language of instruction and examination</td><td colspan="3">Use in other study programs</td></tr>
<tr><td>German and English</td><td colspan="3">B.Eng. Mechanical Engineering
B.Eng. Digital Business Models and Technologies
B.Eng. Electrical Engineering for Sustainable and Renewable Energy
B.Eng. Engineering Physics</td></tr>
<tr><td>Semester and study phase</td><td>Module category</td><td>Duration of module</td><td>Frequency of module offer</td></tr>
<tr><td>1st semester
1st theoretical study phase</td><td>Compulsory module</td><td>One semester</td><td>Once a year in winter semester</td></tr>
<tr><td colspan="4">WORK AND EXAM PERFORMANCE</td></tr>
<tr><td>Participation requirements</td><td colspan="3">Students are only permitted to enter the second part of the semester (second stage of study) if they have completed the German Basics 1 (Level A1) modules in accordance with the appendix to the study and examination requirements.</td></tr>
<tr><td>ECTS-Credits</td><td colspan="3">7 ECTS</td></tr>
<tr><td>Factor of calculation towards degree grade</td><td colspan="3">0,25</td></tr>
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Workload	Overall workload: 360 hours, comprising 135 contact hours and 225 hours self-study
Contact hours per week (SWS)	12
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course Examination method/	**Examination method/ Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 12 SWS	Written exam (90 min.)	Headphones

CONTENT, METHODS AND RESULTS

Course 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. Stu-dents can furthermore use language assistants, apps, online resources and similar tools to manage and expand their language learning.

Learning outcomes

Language Proficiency A2

Spoken interaction

▪ 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.

▪ Can describe plans and arrangements, habits and daily activities and talk about past activities and personal experiences.

▪ 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, biblio-graphies 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.

Teaching and learning methods
German Online Training according to the Common European Framework of Reference (CEFR) will enable to move up an entire language level (A2). The training focuses on listening skills, reading and spoken skills. The materials are e.g. audio files, reading texts, videos and cloze exercises. The course is divided into lessons (learning platform Moodle) that teach the vocabulary and grammar to practice basic scenarios in daily life.
Reading list
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; Wertenschlag, L.. 2013. Profile deutsch A1-C2. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4. 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.

Second theoretical Study Phase – Semester 2 to 4

Technical Mathematics 1 (TMA1)

(Automation and Robotics, B.Eng., SPO 2025)

<table>
<tr><td>Summary</td><td colspan="3">This course covers foundational tools needed to describe and analyze real-world engineering systems. Starting with set theory and complex numbers, the course builds toward understanding limits, calculus, and algebraic equations, all of which are essential for modeling change and solving dynamic problems. Topics like matrices, vector spaces, and linear systems allow for the structured analysis of multi-dimensional systems, forming the mathematical core for future studies in mechanics, control systems, and applied physics.</td></tr>
<tr><td>Instructor responsible for module</td><td colspan="3"></td></tr>
<tr><td>Lecturer</td><td colspan="3">Prof. Dr. Ada Bäumner
Prof. Dr. Roman Rischke</td></tr>
<tr><td>Language of instruction and examination</td><td colspan="3">Use in other study programs</td></tr>
<tr><td>English</td><td colspan="3">B.Eng. Mechanical Engineering
B.Eng. Electrical Engineering for Sustainable and Renewable Energy
B.Eng. Engineering Physics</td></tr>
<tr><td>Semester and study phase</td><td>Module category</td><td>Duration of module</td><td>Frequency of module offer</td></tr>
<tr><td>2nd semester
2nd theoretical study phase</td><td>Compulsory module</td><td>One semester</td><td>Once a year in summer semester</td></tr>
<tr><td colspan="4">WORK AND EXAM PERFORMANCE</td></tr>
<tr><td>Participation requirements</td><td colspan="3"></td></tr>
<tr><td>ECTS-Credits</td><td colspan="3">5 ECTS</td></tr>
<tr><td>Factor of calculation towards degree grade</td><td colspan="3">2</td></tr>
<tr><td>Workload</td><td colspan="3">Overall workload: 150 hours, comprising
▪ 67.5 contact hours
▪ 82.5 hours self-study</td></tr>
<tr><td>Contact hours per week (SWS)</td><td colspan="3">6</td></tr>
<tr><td>Risk assessment for preg-nant women and mothers</td><td colspan="3">Green</td></tr>
</table>

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 6 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course 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)
Learning outcomes
The student is able to apply fundamental concepts of set theory, complex numbers, matrices, determinants, and vector spaces to analyze and solve mathematical problems. He can compute and interpret limits, sequences, series, derivatives, and integrals of univariate real-valued functions, using calculus techniques to model and solve quantitative problems. He is capable of solving linear systems of equations and algebraic equations up to third order, while demonstrating logical reasoning and mathematical rigor in problem-solving.
Teaching and learning methods
Reading list

Technical Mathematics 2 (TMA 2)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	This course focuses on mathematical methods used to model and solve time-dependent and spatially varying systems in engineering. It begins with ordinary differential equations, both first-order and higher-order, which describe dynamic processes such as motion, growth, and decay. Systems of differential equations extend these ideas to coupled phenomena. With vector calculus, including multiple integrals and total differentials, students learn to analyze fields and spatial variations, which are essential in fluid dynamics, thermodynamics, and electromagnetics. The course also introduces partial differential equations for modeling wave motion, heat flow, and other distributed systems, along with numerical integration methods to approximate solutions where analytical ones are difficult or impossible. These tools are crucial for translating physical laws into solvable mathematical models in engineering and applied sciences.		
Instructor responsible for module			
Lecturer	Prof. Dr. Ada Bäumner Prof. Dr. Roman Rischke		
Language of instruction and examination	**Use in other study programs**		
English	B.Eng. Mechanical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
3rd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in winter semester
WORK AND EXAM PERFORMANCE			
Participation requirements			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 67.5 contact hours ▪ 82.5 hours self-study		
Contact hours per week (SWS)	6		
Risk assessment for preg-nant women and mothers	Green		

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 6 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course 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
Learning outcomes
▪ 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
Teaching and learning methods
Reading list

Technical Mathematics 3 (TMA 3)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	This course equips students with essential mathematical techniques for modelling and analysing complex engineering systems.
Instructor responsible for module	
Lecturer	Prof. Dr. Ada Bäumner Prof. Dr. Roman Rischke
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
4th semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 67.5 contact hours ▪ 82.5 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 6 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course 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

Learning outcomes
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.
Teaching and learning methods
Reading list

Mathematical Applications

(Automation and Robotics, B.Eng., SPO 2025)

<table>
<tr><td>Summary</td><td colspan="3">Based on real-world data and case studies, this course teaches students to apply numerical methods, data analysis, and modeling tech-niques to solve practical engineering problems. Topics include numerical integration, solving differential equations, and large-scale linear systems, supported by Python-based computation. Students explore statistics, data visualization, PCA, and SVD to extract insights from complex datasets, while signal processing tools such as Fourier transforms and filtering techniques are used for analyzing dynamic signals. The course also covers optimization, machine learning fundamentals (classification, regression, clustering), and techniques for physical modeling, Monte Carlo simulation, and stochastic processes. Throughout the course, Python is used to build, simulate, and analyze mathematical models, culminating in a project-based application that integrates theory with practical problem-solving.</td></tr>
<tr><td>Instructor responsible for module</td><td colspan="3"></td></tr>
<tr><td>Lecturer</td><td colspan="3"></td></tr>
<tr><td>Language of instruction and examination</td><td colspan="3">Use in other study programs</td></tr>
<tr><td>English</td><td colspan="3">B.Eng. Mechanical Engineering
B.Eng. Electrical Engineering for Sustainable and Renewable Energy
B.Eng. Engineering Physics</td></tr>
<tr><td>Semester and study phase</td><td>Module category</td><td>Duration of module</td><td>Frequency of module offer</td></tr>
<tr><td>4th semester
3rd theoretical study phase</td><td>Compulsory module</td><td>One semester</td><td>Once a year in summer semester</td></tr>
<tr><td colspan="4">WORK AND EXAM PERFORMANCE</td></tr>
<tr><td>Participation requirements</td><td colspan="3"></td></tr>
<tr><td>ECTS-Credits</td><td colspan="3">5 ECTS</td></tr>
<tr><td>Factor of calculation towards degree grade</td><td colspan="3">2</td></tr>
<tr><td>Workload</td><td colspan="3">Overall workload: 150 hours, comprising
▪ 45 contact hours
▪ 105 hours self-study</td></tr>
<tr><td>Contact hours per week (SWS)</td><td colspan="3">4</td></tr>
<tr><td>Risk assessment for preg-nant women and mothers</td><td colspan="3">Green</td></tr>
</table>

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 4 SWS	Practical course project (lab report, survey, project, or field report)	

CONTENT, METHODS AND RESULTS
Course 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 Modelling and Simulation ▪ Physical Modelling with Differential Equations ▪ Monte Carlo Methods ▪ Stochastic Simulations and Random Processes

Learning outcomes
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
Teaching and learning methods
Reading list

<table>
<tr><td colspan="4">

Mechanics 1 (MEC1)

(Automation and Robotics, B.Eng., SPO 2025)</td></tr>
<tr><td>Summary</td><td colspan="3">▪ 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.</td></tr>
<tr><td>Instructor responsible for module</td><td colspan="3">Carlo Höhn (M.Eng.)</td></tr>
<tr><td>Lecturer</td><td colspan="3">Carlo Höhn (M.Eng.)</td></tr>
<tr><td>Language of instruction and examination</td><td colspan="3">Use in other study programs</td></tr>
<tr><td>English</td><td colspan="3">B.Eng. Mechanical Engineering
B.Eng. Engineering Physics</td></tr>
<tr><td>Semester and study phase</td><td>Module category</td><td>Duration of module</td><td>Frequency of module offer</td></tr>
<tr><td>2nd semester
2nd theoretical study phase</td><td>Compulsory module</td><td>One semester</td><td>Once a year in summer semester</td></tr>
<tr><td colspan="4">WORK AND EXAM PERFORMANCE</td></tr>
<tr><td>Participation requirements</td><td colspan="3"></td></tr>
<tr><td>ECTS-Credits</td><td colspan="3">5 ECTS</td></tr>
<tr><td>Factor of calculation towards degree grade</td><td colspan="3">2</td></tr>
<tr><td>Workload</td><td colspan="3">Overall workload: 150 hours, comprising
▪ 45 hours lectures
▪ 105 hours self-study, including 11 hours guided exercise</td></tr>
<tr><td>Contact hours per week (SWS)</td><td colspan="3">4</td></tr>
</table>

<table>
<tr><td>Risk assessment for preg-nant women and mothers</td><td colspan="2">Green</td></tr>
<tr><td>Type and scope of the course
Examination method/</td><td>Examination method/
Requirements for the allocation of credit points</td><td>Approved examination aids</td></tr>
<tr><td>Seminar-based teaching, exercise
4 SWS</td><td>Written exam (90-120 min.)</td><td></td></tr>
<tr><td colspan="3">CONTENT, METHODS AND RESULTS</td></tr>
<tr><td colspan="3">Course content</td></tr>
<tr><td colspan="3">
▪ 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
</td></tr>
<tr><td colspan="3">Learning outcomes</td></tr>
<tr><td colspan="3">
▪ 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.
</td></tr>
<tr><td colspan="3">Teaching and learning methods</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Reading list</td></tr>
<tr><td colspan="3"></td></tr>
</table>

Mechanics 2 (MEC2)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Almost all classical machines have systems with moving components, which are typically modeled as mass points or rigid bodies. The mathematical description of motion processes is carried out using vectors in Cartesian or polar coordinates, for example. Newton's second axiom is used to analyze the effect of forces. The solution of the equation of motion formulated in this way, which is a differential equation for the position coordinate of the corresponding body, provides information about the temporal and spatial properties of a mechanical system. Finally, the methods based on Newton's second axiom can also be used to calculate special motion processes such as oscillations or impact processes.
Instructor responsible for module	
Lecturer	
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Mechanical Engineering B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
3rd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE	
Participation requirements	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course 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
▪ Definition of angular momentum
▪ 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

Learning outcomes

Students describe the motion of bodies mathematically, defining velocity and acceleration in Cartesian and polar coordinates for linear, circular, and planar movements. They gain the ability to analyse motion using the mass-point model, applying Newton’s second law, studying free and guided motions, and understanding oscillations and impact processes. They analyse rigid-body motion, including rotation about fixed axes, angular momentum, torque, moment of inertia, and rolling processes. They develop a clear understanding of planar rigid-body movements through concepts such as the momentary pole and ideal rolling. Finally, they define basic formulas for work, energy, and power, enabling them to evaluate mechanical systems in practical engineering contexts.

Teaching and learning methods

Reading list

Measurement Technology (MT)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	When taking measurements, it is important to minimize the inevitable measurement error that occurs depending on the equipment used and its surroundings. The module Measurement Technology covers how measurement errors and uncertainties occur, how to quantify, minimize and handle them. This is done by going through the basic concepts of metrology and followed by addressing a range of measuring techniques and instruments with their characteristic behaviour. The combined lecture/exercise is accompanied by laboratory exercise to gain hands-on experience on the subject.		
Instructor responsible for module	Prof. Dr. Bettina Friedel		
Lecturer	Prof. Dr. Bettina Friedel		
Language of instruction and examination	**Use in other study programs**		
English	B.Eng. Electrical ENoingineering for Sustainable and Renewable Energy B.Eng. Engineering Physics		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
2nd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in summer semester
WORK AND EXAM PERFORMANCE			
Participation requirements	None		
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours/lab ▪ 90 hours of self-study		
Contact hours per week (SWS)	4 SWS		
Risk assessment for pregnant women and mothers	Green		
Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**	
Seminar-based teaching, exercise, internship 3 SWS Seminar + 1 SWS integrated exercises	Written exam (90-120 min.)	non-programmable calculator, provided formulary	

CONTENT, METHODS AND RESULTS
Course 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 peri-odic measurement signals
Learning outcomes
The course introduces fundamental measurement concepts including units, standards, uncertainty, and common measurement errors. Students learn how measuring instruments such as multimeters, oscilloscopes, and various sensors work, along with methods for measuring static and dynamic electrical quantities. They also study periodic signals in both the time and frequency domains and gain an understanding of digital measurement techniques like sampling and quantization. Through practical experiments, students apply these theoretical principles and develop hands-on skills for analysing and interpreting electrical measurement data.
Teaching and learning methods
on-site beamer-based presentation with integrated problem-solving sessions and discussion; electronic lecture notes
Reading list
▪ # Raghavendra, N. V., & Krishnamurthy, L. (2013). Engineering Metrology and Measurements. Oxford University Press. ISBN 978-0-19-808549-2 ▪ # Morris, A. S. (2001). Measurement and instrumentation principles (3rd ed.). Butterworth-Heinemann. ISBN 978-0-7506-5081-6 ▪ # Tumanski, S. (2006). Principles of electrical measurement. CRC Press. ISBN 978-0-7503-1038-3 ▪ # Bentley, J. P. (2005). Principles of measurement systems (4th ed.). Pearson Education. ISBN 978-0-13-043028-1

Fundamentals of Electrical Engineering (FEE)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The module covers fundamentals of electrical engineering, focusing on direct and alternating current circuits, including analysis methods and components. Key topics include electric and magnetic fields, field strength, voltage, potential, and capacitance. It also addresses material behavior in fields, electromagnetic induction, and energy and force calculations.
Instructor responsible for module	Prof. Dr. Bernd Hüttl
Lecturer	Prof. Dr. Bernd Hüttl
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Mechanical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
2nd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Contact hours per week (SWS)	4
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course Examination method/	**Examination method/ Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	Own formula collection (out-come of course) Pocket calculator

CONTENT, METHODS AND RESULTS

Course 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.

Learning outcomes

After attending this module, students are aware of fundamental electrical engineering. Students are able to understand the basics of dircect and alternating current technology within circuits with linear two-poles. Moreover the basics of electric and magnetic fields and electromagnetic induction are understood and are available as basic knowledge to solve simple problems and discuss easy applications.

Teaching and learning methods

The module consists of a series of lectures. In these lectures, the theoretical basics are taught and exercises are carried out together. In special exercise sessions, the tasks from the exercise sheets (if necessary) are discussed and solved together. The script is created using an electronic whiteboard (iPad) and is available as pdf-file. All graphics and circuits are presented in digital form.

Reading list
▪ “Fundamentals of Electric Circuits”, Ch. Alexander, M. Sadiku, McGraw-Hill Education, ISBN-13 : 978-1260570793 ▪ “Fundamentals of Applied Electromagnetics”, F. Ulaby, U. Ravaioli, Pearson Education, ISBN-13 : 978-1292436739 ▪ “Electrical Engineering: Fundamentals”, V. Hacker, Ch. Sumereder, De Gruyter Oldenbourg; ISBN-13 : 978-3110521023 ▪ “Electrical Engineering: Principles & Applications, Global Edition: principles and applications”, A. Hambley, Pearson; ISBN-13 : 978-1292223124 ▪ “Grundgebiete der Elektrotechnik, Bd. 1 und 2”, A. Führer, K. Heidemann, W. Nerreter: Hanser Verlag; ISBN-13 : 978-3446459533

Fundamentals of Business Administration

(FBusiAdmin)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Within the framework of this lecture, the fundamentals of business administration will be covered. In particular, students will be enabled to understand basic business terms and economic contexts, know and describe the most important constitutive decisions of a company, analyze and explain the management process of any company, and link the elements of this process with the company's goals. Furthermore, the aim of this lecture is to explain the essential functions in the processes of business performance creation and to demonstrate their interaction.		
Instructor responsible for module			
Lecturer			
Language of instruction and examination	**Use in other study programs**		
English	B.Eng. Mechanical Engineering		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
3rd term, 2nd theoretical study phase	Compulsory module	One term	Once a year in winter term
WORK AND EXAM PERFORMANCE			
Participation requirements	None		
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Contact hours per week (SWS)	4		
Risk assessment for preg-nant women and mothers	Green		

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course 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

Learning outcomes

Students will understand the management process, including how organizations set goals, plan activities, make decisions, control outcomes, and structure internal workflows. They will learn how constitutive decisions such as choosing a business model, selecting a location, forming cooperations, and determining a legal form shape a company’s long-term direction. They will be able to explain how each value-chain function—from research and development to customer service—contributes to creating and delivering value. They will gain insight into essential operational areas like finance, human resources, and IT and how these support overall business performance. By learning these foundations, students will be equipped to analyze how companies operate, make strategic choices, and coordinate functional areas effectively.

Teaching and learning methods

Reading list

Fundamentals in Computer-based Measurement Technology

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Students will understand the fundamental principles of measurement technology, including sensor types, measurement chains, and the detection of mechanical, thermodynamic, electromagnetic, and optical quantities. They will be able to condition and digitize signals through amplification, range adjustment, sampling, and the use of DACs and ADCs, while also applying concepts such as number systems, sampling theorem, and windowing. They will gain competence in data communication interfaces such as RS-232, USB, GPIB, VISA, and SCPI, as well as in digital data processing using filters and the DFT. In the laboratory, they will learn to build measurement circuits on a breadboard, apply operational amplifiers, measure voltages, currents, and resistances, and work with microcontrollers using MicroPython. By the end, they will be capable of designing and implementing a complete digital measurement system, including sensor acquisition, analogue frontends, high-resolution ADCs, PC communication, and GUI-based data evaluation.		
Instructor responsible for module	Prof. Dr. Conrad Wolf		
Lecturer	Prof. Dr. Conrad Wolf		
Language of instruction and examination	**Use in other study programs**		
English	B.Eng. Engineering Physics B.Eng. Electrical Engineering for Sustainable and Renewable Energy		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
3rd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in winter semester
WORK AND EXAM PERFORMANCE			
Participation requirements			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours self-study		
Contact hours per week (SWS)	4		

Risk assessment for pregnant women and mothers	Green

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise, internship 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course 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

Learning outcomes
Measurement technology constitutes an essential foundation for executing physical experiments and enabling technological advancement, with contemporary practice relying predominantly on digital data acquisition and computer-based processing. Within this module, students will become familiar with common sensor technologies and learn to condition their signals through suitable measurement circuits to ensure compatibility with an analogue-to-digital converter. They acquire the ability to transfer measurement data to a PC and perform systematic evaluation using appropriate software tools. In the laboratory component, students can independently construct measurement circuits on a breadboard, interface various sensors with a microcontroller, and implement corresponding measurement routines. Through this integrated theoretical and practical approach, they can understand digital measurement systems and their application in experimental and technological contexts.
Teaching and learning methods
Reading list

Programming (PG)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The lecture provides in-depth knowledge of Python programming fundamentals, including variables, core data types, expressions, and essential control structures such as conditionals and loops. Students learn to work with key data structures, write functions, handle files and exceptions, and structure code effectively. Additionally, they develop foundational skills in object-oriented programming and learn to use and create modules and packages to build more organized and powerful programs.
Instructor responsible for module	Prof. Dr. Jochen Merhof
Lecturer	Prof. Dr. Jochen Merhof
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Mechanical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
2nd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course 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
Learning outcomes
The student can develop Python programs using variables, data types, expressions, control structures, and basic data structures to solve computational problems effectively. He can design modular and robust applications by implementing functions, handling files, and managing runtime errors through exception handling techniques. He can apply object-oriented programming principles, including classes, inheritance, polymorphism, and method overriding, to create reusable and maintainable software solutions.
Teaching and learning methods
Reading list

Fluid Mechanics

(Automation and Robotics, B.Eng., SPO 2025)

Summary	This introductory course in fluid mechanics covers the fundamental principles governing fluid behavior in engineering systems. Students will learn to analyze hydrostatic forces, apply the continuity and energy equations to pipe flows, and use the momentum conservation theorem to calculate forces and moments in fluid systems. The course also introduces key concepts of fluid kinematics, viscous flows, and distinguishes between laminar and turbulent regimes. Basic heat transfer by conduction is included to provide a foundation for thermal-fluid applications. Emphasis is placed on developing problem-solving skills for real-world engineering scenarios involving incompressible flow and heat transfer in pipes and other systems.
Instructor responsible for module	Prof. Dr. Philipp Epple
Lecturer	Prof. Dr. Philipp Epple
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Electrical Engineering for Sustainable and Renewable Energy

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
3th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Contact hours per week (SWS)	4
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise, 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course content

Students will be able to:

Analyze hydrostatic systems:

- Calculate pressure, determine forces and moments

Apply core fluid mechanics equations:

- One-dimensional continuity equation for pipe flows
- Steady and unsteady energy equation (Bernoulli equation)
- Momentum conservation theorem to calculate forces and moments in pipe systems

Evaluate thermal systems:

- Calculate heat transfer by conduction in simple configurations

Students will understand:

Fundamental fluid mechanics concepts:

- Basic principles and hydrostatics
- Fluid kinematics
- Incompressible flows and streamline theory

Governing equations:

- Continuity equation, Energy equation (Bernoulli), Momentum conservation theorem

Flow behavior:

- Fundamentals of viscous flows
- Characteristics of laminar and turbulent flows
- Pipe flow dynamics

Heat transfer:

- Basic conduction processes

Learning outcomes

Students analyse hydrostatic systems by calculating pressure, forces, and moments using core principles such as the continuity equation, Bernoulli's energy equation, and the momentum conservation theorem. They apply these equations to pipe flows—both steady and unsteady—and to determine how forces act within fluid systems. Students also develop skills in evaluating thermal systems, including calculating heat transfer by conduction in simple geometries using basic conduction processes. They build a conceptual foundation in fluid mechanics, covering hydrostatics, fluid kinematics, incompressible flow behaviour, and the differences between laminar and turbulent regimes. Finally, they understand governing equations and flow dynamics well enough to analyse pipe flows and apply momentum, energy, and continuity principles confidently in engineering contexts.

Teaching and learning methods

Reading list

Thermodynamics

(Automation and Robotics, B.Eng., SPO 2025)

Summary	This course provides a foundational introduction to engineering thermodynamics, focusing on the principles governing energy, heat, and work in mechanical systems. Students will learn to distinguish between system states and processes, analyze phase diagrams, and apply thermodynamic laws to both closed and open systems. Key topics include the behavior of ideal gases and gas mixtures, moist air, and steam; the first and second laws of thermodynamics; and the analysis of cyclic pro-cesses in power-adding and power extracting machines. The course also introduces selected adiabatic flow processes relevant to real-world engineering applications.
Instructor responsible for module	
Lecturer	
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
4th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE	
Participation requirements	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Contact hours per week (SWS)	4
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course content

Students will be able to:

Distinguish between:

- State variables
- Process variables

Calculate:

- Specific gas constants
- State variables in the two-phase region
- Properties of ideal gases and gas mixtures
- Cyclic thermodynamic processes

Understand and apply:

- Phase diagrams
- The first law of thermodynamics to closed and open systems
- The second law of thermodynamics to various systems

Students will understand:

Concepts of:

- System and state
- Processes and process variables

Thermodynamic principles:

- First law of thermodynamics
- Second law of thermodynamics

Behavior of:

- Ideal gases and their state variables
- Gas mixtures, moist air, and steam

Analysis of:

- Phase diagrams
- Cyclic processes in power-generating and work-absorbing machines
- Selected adiabatic flow processes

Learning outcomes

Students gain the ability to distinguish clearly between state variables and process variables, enabling precise description of system behaviour. They learn to calculate specific gas constants, determine state variables in the two-phase region, and evaluate properties of ideal gases, gas mixtures, and cyclic thermodynamic processes. They develop competence in applying phase diagrams as well as the first and second laws of thermodynamics to both closed and open systems. They build a solid conceptual foundation covering systems, states, processes, ideal-gas behaviour, moist air, steam, and selected adiabatic flow processes. Finally, they understand and analyse cyclic processes in power-generating and work-absorbing machines using governing equations such as continuity, energy, and momentum conservation.

Teaching and learning methods
Reading list

Control Systems

(Automation and Robotics, B.Eng., SPO 2025)

Summary	In this module, basic competencies in linear systems modeling, analysis and controller design are acquired. Students will be able to describe systems and their characteristics in various domains, combine selected controllers and plants and design control-loops with respect to given performance requirements in time- and frequency domains.
Instructor responsible for module	Prof. Dr. Kolja Kühnlenz
Lecturer	Prof. Dr. Kolja Kühnlenz
Language of instruction and examination	Use in other study programs
English	B.Eng. Mechanical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	Module category	Duration of module	Frequency of module offer
4th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 60 hours on-site and online lecture (alternating) ▪ 90 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course 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, PTn,PDT1 **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
Learning outcomes
Students understand dynamic systems using tools such as differential equations, transfer functions, Bode diagrams, Nyquist plots, and state-space models. They gain the ability to analyse system behaviour, perform linearization, and understand closed-loop structures. The student becomes familiar with typical controllers and plants—including P, I, D, PTn, and PDT1—and learns how these elements interact in practical control setups. They develop competence in evaluating system stability using concepts like BIBO stability, Lyapunov stability, the Routh-Hurwitz criterion, and Lyapunov's direct method. Finally, they learn to design closed-loop controllers in both the time and frequency domains, applying performance criteria to typical controller-plant combinations.
Teaching and learning methods
Reading list

Electrical Drives, Power Grids and Safety (EANz)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The module teaches essential principles of DC and three-phase machines along with core electrical-grid analysis, enabling students to understand machine operation and perform key calculations for power systems.
Instructor responsible for module	Prof. Dr. Omid Forati Kashani
Lecturer	Prof. Dr. Omid Forati Kashani
Language of instruction and examination	**Use in other study programs**
English	B.Eng. Electrical Engineering for Sustainable and Renewable Energy

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
4th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation 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.
ECTS-Credits	5
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 60 contact hours ▪ 90 hours of self-study
Contact hours per week (SWS)	In-person lecture (2 SWS), in-person exercise (1 SWS), in-person practical work (1 SWS) / 4 SWS
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.) Practical coursework (laboratory report, survey, project or work placement report)	

CONTENT, METHODS AND RESULTS

Course 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 types (TN, TT, IT), fuse elements, protection regulations. Cable structures, installation methods, voltage drop calculations.
Learning outcomes
In this module students understand fundamentals of DC Machines and topologies of static converters which can be used feeding DC Machines. They also apply 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 apply the fundamentals of electrical energy transmission and power analysis in three-phase grids. They will know 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.
Teaching and learning methods
Blackboard, overhead / beamer / document camera /white board / Electronically provided work documents and exercises / practical exercises on the test bench in the laboratory

Reading list
▪ Rolf Fischer, elektrische Maschinen, Karl Hanser Verlag München ▪ Helmut Späth, elektrische Maschinen und Strom-richter, Verlag Braun Karlsruhe ▪ Johannes Teigelkötter, Energieeffiziente elektrische Antriebe, Springer Verlag ▪ Joachim Specovius, Grundkurs Leistungselektronik, 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 Niederspannungs- und Sicherheitsanlagen, Hüthig und Pflaum ▪ Klaus Heuck, Klaus-Dieter Dettmann; elektrische Energieversorgung; Vieweg-Verlag

German Basics 3, Level B1.1 (GB3)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The German Basics 3 (Level B1.1) course is designed for international students with basic German language skills (Level A2). The aim is to enlarge the repertoire of linguistic and cultural competences and to enable students to acquire study and work-related topics in oral and written communication, to be aware of cultural differences between their country of origin and Germany and to interact flexibly with culturally influenced forms of behaviour. The course content is tailored to the needs of the target group (e.g. internship). These are … ▪ practice-oriented learning objectives (aligned by typical language/writing activities) ▪ Basic vocabulary ▪ Written communication: text type specific structures ▪ Teaching learning strategies to enable autonomous learning ▪ Use of authentic material The focus is on everyday communication in studies and work, (lexis and grammar follow this content (form follows content/function)		
Instructor responsible for module	Dr. Edgar Skvotsov		
Lecturer	Dr. Edgar Skvotsov		
Language of instruction and examination	**Use in other study programs**		
German and English	B.Eng. Engineering Physics B.Eng. Mechannical Engineering B.Eng. Electrical Engineering for Sustainable and Renewable Energy		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
2nd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in summer semester
WORK AND EXAM PERFORMANCE			
Participation requirements			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	0,5		
Workload	Overall workload: 120 hours, comprising ▪ 45 contact hours ▪ 75 hours self-study		
Contact hours per week (SWS)	4		

Risk assessment for pregnant women and mothers	Green	
Type and scope of the course Examination method/	**Examination method/** Requirements for the allocation of credit points	**Approved examination aids**
Seminar-based teaching, exercise, 4 SWS	Written exam (90-120 min.)	Notebook, Tablet, Headphones

CONTENT, METHODS AND RESULTS

Course 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.

Language Proficiency B1.1

Spoken interaction

▪ Can give straightforward descriptions or reports on a range of familiar topics in own field of interest

▪ Can give short reasons or explanations for views, plans or actions.

▪ 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

▪ 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 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.

References:

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

Learning outcomes
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.
Teaching and learning methods
Reading list
▪ 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 German 1, Level B1.2 (TG 1)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The Technical German (Level B1.2) course is designed for international students with independent German language skills (Level B1.1). The aim is to enlarge the repertoire of linguistic and cultural competences and to enable students to acquire study and work-related topics in oral and written communication, to be aware of cultural differences between their country of origin and Germany and to interact flexibly with culturally influenced forms of behaviour. The course content is tailored to the needs of the target group (e.g. internship). These are … ▪ practice-oriented learning objectives (aligned by typical language/writing activities) ▪ Basic vocabulary ▪ Written communication: text type specific structures ▪ Teaching learning strategies to enable autonomous learning ▪ Use of authentic material The focus is on everyday communication in studies and work, (lexis and grammar follow this content (form follows content/function)
Instructor responsible for module	Dr. Edgar Skvorcov
Lecturer	Dr. Edgar Skvorcov
Language of instruction and examination	**Use in other study programs**
German	B.Eng. Mechanical Engineering B.Eng. Digital Business Models and Technologies B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
3rd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE	
Participation requirements	-
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,5
Workload	
Contact hours per week (SWS)	4

Risk assessment for preg-nant women and mothers	Green	
Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course 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. References: 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; Wertenschlag, L.. 2013. Profile deutsch. 1. Aufl.. Lernzielbestimmungen, Kannbeschreibungen, Kommunikative Mittel. Stuttgart: Klett, ISBN 978-3-12-606518-4.

Technical German 2, Level B2.1 (TG 2)

Summary	
Instructor responsible for module	Dr. Edgar Skvorcov
Lecturer	Dr. Edgar Skvorcov
Language of instruction and examination	**Use in other study programs**
German	B.Eng. Electrical Engineering for Sustainable and Renewable Energy

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
3rd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE	
Participation requirements	
ECTS-Credits	
Factor of calculation towards degree grade	
Workload	
Contact hours per week (SWS)	
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course content
Learning outcomes

Teaching and learning methods
Reading list

Third theoretical Study Phase – Semester 5 and 6

Computermesstechnik
(Computer based Measurement Technology)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	
Instructor responsible for module	Prof. Dr. Merhof
Lecturer	Prof. Dr. Merhof
Language of instruction and examination	**Use in other study programs**
German	None

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
5rd term 3rd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Contact hours per week (SWS)	4
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course content
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.
Learning outcomes
Teaching and learning methods
Reading list

Softwareentwurf in der Automatisierungstechnik
(Software Development in Automation, SwAu)

(Automation and Robotics, B.Eng., SPO 2025)

<table>
<tr><td colspan="2">Summary</td><td colspan="3">This module provides a comprehensive introduction to modern automation and control engineering, covering controller configuration, industrial communication systems, fieldbus technologies, distributed automation according to IEC 61499, and programming with Structured Text based on IEC 61131-3. Students also learn software engineering principles, including the V-Model, sequential programming, object-oriented programming, class and state diagram design, and the development of reusable software libraries following professional programming standards. Practical laboratory exercises reinforce these topics through hands-on work with communication protocols, visualization systems, sequence control, state-based operation, object-oriented design, library creation, and system commissioning.</td></tr>
<tr><td colspan="2">Instructor responsible for module</td><td colspan="3">Prof. Dr.-Ing. Matthäus Brela</td></tr>
<tr><td colspan="2">Lecturer</td><td colspan="3">Prof. Dr.-Ing. Matthäus Brela</td></tr>
<tr><td colspan="2">Language of instruction and examination</td><td colspan="3">Use in other study programs</td></tr>
<tr><td colspan="2">German</td><td colspan="3">None</td></tr>
<tr><td>Semester and study phase</td><td colspan="2">Module category</td><td>Duration of module</td><td>Frequency of module offer</td></tr>
<tr><td>5th semester
3rd theoretical study phase</td><td colspan="2">Compulsory module</td><td>One semester</td><td>Once a year in winter semester</td></tr>
<tr><td colspan="5">WORK AND EXAM PERFORMANCE</td></tr>
<tr><td colspan="2">Participation requirements</td><td colspan="3">None</td></tr>
<tr><td colspan="2">ECTS-Credits</td><td colspan="3">5 ECTS</td></tr>
<tr><td colspan="2">Factor of calculation towards degree grade</td><td colspan="3">2</td></tr>
<tr><td colspan="2">Workload</td><td colspan="3">Overall workload: 150 hours, comprising
▪ 60 hours on-site and online lecture (alternating)
▪ 90 hours self-study</td></tr>
<tr><td colspan="2">Contact hours per week (SWS)</td><td colspan="3">4</td></tr>
<tr><td colspan="2">Risk assessment for pregnant women and mothers</td><td colspan="3">Green</td></tr>
</table>

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS

Course 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.

Learning outcomes

- 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.

Teaching and learning methods

Projector and board/whiteboard, simulation programs, electronic scripts and working materials, practical exercises.

Reading list
- 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

Robotik (Robotics, Ro)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The module provides theoretical and practical foundations for robotic motion generation, dynamic modelling, advanced control strategies, and algorithmic path planning in robotic systems.
Instructor responsible for module	Prof. Dr. Kolja Kühnlenz
Lecturer	Prof. Dr. Kolja Kühnlenz
Language of instruction and examination	**Use in other study programs**
German	None

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
5th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE

Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising • 60 contact hours • 90 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise, internship 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course 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
Learning outcomes
Students can model, analyze, and solve robotic motion problems using homogeneous transformations, direct and inverse kinematics, Jacobian-based methods, and the identification of kinematic singularities. They can derive and apply dynamic models of robotic systems using Lagrangian mechanics and implement advanced control strategies such as position, trajectory, and computed-torque control. Furthermore, they can plan robot motions in complex environments using graph-based and cell-based path planning approaches and integrating these methods into autonomous robotic control systems.
Teaching and learning methods
Reading list

Signale und Systeme (Signals and Systems, SuS)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The module provides theoretical and practical foundations in the analysis and modelling of continuous-time and discrete-time signals and systems, including system representation, time- and frequency-domain methods, Laplace and Z-transformations, convolution, sampling, and frequency response analysis.
Instructor responsible for module	Prof. Dr. Kolja Kühnlenz
Lecturer	Prof. Dr. Kolja Kühnlenz
Language of instruction and examination	**Use in other study programs**
German	None

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
5th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE

Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising • 60 contact hours • 90 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course 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
Learning outcomes
• Students can explain and evaluate the basic properties of signals and systems • Students can describe and calculate linear time-invariant (LTI) systems in their continuous-time representation (linear differential equations, convolution operation, convolution integral) • Students can describe and calculate continuous LTI systems in the frequency domain (Fourier transform) • Students can describe and calculate continuous LTI systems in the image domain (Laplace transform) • Students can explain the sampling operation and its significance in the time and frequency domain • Students can describe and calculate linear time-invariant (LTI) systems in their discrete-time representation (z-transform)
Teaching and learning methods
Projector, presentation slides, blackboard/whiteboard, course materials in electronic form, use of an e-learning system, mathematical application software
Reading list

Automatisierungstechnik (Factory Automation, AU2)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Automated production systems integrate advanced automation technologies to optimize manufacturing processes, with performance evaluated through indicators such as availability, process data analysis, and Overall Equipment Effectiveness (OEE). Sensor and actuator technologies provide the foundation for process measurement, testing, and control by applying various measurement principles and diagnostic methods. Condition monitoring utilizes the acquisition and statistical analysis of measurement data, including parameters such as mean value, RMS, crest factor, skewness, kurtosis, and Fourier analysis, to assess system health and process stability. Communication in automation technology relies on industrial networks, communication architectures, transmission methods, and protocols such as TCP/IP, OPC UA, MQTT, EtherCAT, and ProfiNet to ensure reliable data exchange and interoperability. The field is further supported by cybersecurity mechanisms, including encryption and certificate management, as well as practical laboratory applications involving process optimization, industrial communication, and automated process control systems.
Instructor responsible for module	Prof. Dr.-Ing. Matthäus Brela
Lecturer	Prof. Dr.-Ing. Matthäus Brela
Language of instruction and examination	**Use in other study programs**
German	None

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
6th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE	
Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 60 hours lectures ▪ 90 hours self-study

Contact hours per week (SWS)	4 in-person seminar (1 SWS) and practical work (3 SWS)		
Risk assessment for pregnant women and mothers	Green		
Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**	
Seminar-based teaching, exercise 4 SWS	Practical coursework (laboratory report, survey, project or work placement report)		

CONTENT, METHODS AND RESULTS

Course 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

Learning outcomes
• 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 can name 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 can describe the reference architecture model of Industry 4.0. • They can enable communication between processes using OPC-UA and MQTT protocols.
Teaching and learning methods
Projector and board/whiteboard, simulation programs, electronic scripts and working materials, practical exercises.
Reading list
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 Ver-lag, 2015 Langmann, R.: Pocket Book of Automation, 3rd edition, Carl Hanser Verlag, 2017

Antriebs- und Bewegungssteuerung (Motion Control, MoCo)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Students learn the fundamentals of motion automation, including kinematic and dynamic principles of translational and rotational movements, coordinate transformations, power flow, force and torque relationships, and vibration behaviour. It explains the key control and measurement technologies used in automated motion systems, such as current, speed, and position control as well as sensors for position, velocity, acceleration, force, and torque monitoring. In addition, students learn the design and operation of stepper and servo drive systems, the use of PLCopen motion control function blocks, and gain practical experience through laboratory exercises involving positioning, interpolation, synchronization, diagnostics, and safety functions.		
Instructor responsible for module	Prof. Dr.-Ing. Matthäus Brela		
Lecturer	Prof. Dr.-Ing. Matthäus Brela		
Language of instruction and examination	**Use in other study programs**		
German	None		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
6th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in summer semester
WORK AND EXAM PERFORMANCE			
Participation requirements	None		
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising • 60 contact hours • 90 hours self-study		
Contact hours per week (SWS)	4		
Risk assessment for pregnant women and mothers	Green		

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.) Practical coursework (laboratory report, survey, project or work placement report)	

CONTENT, METHODS AND RESULTS

Course 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.

Learning outcomes
- The students can analyze technical motion processes and describe them mathematically.   - They can 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 can design 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.
Teaching and learning methods
Projector and board/whiteboard, simulation programs, electronic scripts and working materials, practical exercises.
Reading list
- 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

Industrielle Bildverarbeitung (Industrial Computer Vision, MoCo)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The module provides theoretical and practical foundations in computer vision and image processing, including CCD/CMOS sensor technology, image enhancement, segmentation, feature and edge extraction, classification methods, camera calibration, and stereo-based 3D reconstruction.
Instructor responsible for module	Prof. Dr. Kolja Kühnlenz
Lecturer	Prof. Dr. Kolja Kühnlenz
Language of instruction and examination	**Use in other study programs**
German	None

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
6th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising • 60 contact hours • 90 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.) Practical coursework (laboratory report, survey, project or work placement report)	

CONTENT, METHODS AND RESULTS

Course 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
Learning outcomes
Students can explain the operating principles of machine vision systems, including image sensors, colour vision, and communication interfaces, and evaluate their suitability for industrial applications. They can apply the complete image processing pipeline, from image acquisition and enhancement to segmentation, feature extraction, edge detection, and classification. Furthermore, they can calibrate camera systems and use stereo reconstruction techniques to derive spatial information and support machine vision-based automation tasks.
Teaching and learning methods
Reading list
•

Seminar Automation and Robotik (Seminar Automation and Robotics)

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The module provides methodological and practical foundations in scientific research, academic writing, literature review, critical discussion of technical topics, and the systematic preparation of scientific reports in the context of current research and technology.
Instructor responsible for module	Prof. Dr. Kolja Kühnlenz
Lecturer	Prof. Dr. Kolja Kühnlenz
Language of instruction and examination	**Use in other study programs**
German	None

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
6th semester 3rd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation requirements	None
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising • 60 contact hours • 90 hours self-study
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.) Practical coursework (laboratory report, survey, project or work placement report)	

CONTENT, METHODS AND RESULTS

Course content
Students work independently on a seminar paper on more demanding scientific topics from basic areas or on state-of-the-art 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.
Learning outcomes
Students 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.
Teaching and learning methods
Reading list
•

Technical German 3, Level B2.2 (TG 3)

Summary	Students develop German language proficiency and intercultural communication skills for everyday life and academic studies, while enhancing their understanding of linguistic structures and cultural contexts through a multilingual, CLIL-based learning approach.
Instructor responsible for module	Dr. Edgar Skvorcov
Lecturer	Dr. Edgar Skvorcov
Language of instruction and examination	**Use in other study programs**
German	B.Eng. Electrical Engineering for Sustainable and Renewable Energy

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
5th semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in winter semester

WORK AND EXAM PERFORMANCE	
Participation requirements	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,5
Workload	150 hours
Contact hours per week (SWS)	4
Risk assessment for preg-nant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar-based teaching, exercise 4 SWS	Written exam (90-120 min.)	

CONTENT, METHODS AND RESULTS
Course 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.
Learning outcomes
Language Proficiency B2.2 (Independent User, CEFR) **Spoken interaction** • Students can understand key information in presentations, lectures and brief discourses on well-known topics in their field of specialisation or interest. • Students can give a short report on a selected specialised topic. • Students can actively contribute to formal discussions by giving arguments for their own point of view and commenting on comments made by others. **Reading Comprehension** • Students can understand and compare sources of information and arguments in scientific texts. • Students can understand a specific procedure on the basis of a diagram. • Students can quickly find key details in long and complex general and specialised texts. **Written production** • Students can write address-oriented, clearly structured texts on a complex topic and summarise the most important points in them. • Students can formulate descriptive titles (e.g. for a presentation) • Students can write a summary of articles and reports on specialised topics of general interest.
Teaching and learning methods
Notebook, Tablet, Headphones
Reading list
• 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] • *Gemeinsamer Europäischer Referenzrahmen für Sprachen*: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] • 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. • 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]. • 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].

Introduction in Scientific Writing, Level C1.1

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Students develop academic reading and writing skills, learn the conventions of scholarly texts, and gain practical competencies in planning, managing, reflecting on, and successfully completing academic writing projects such as a bachelor's thesis.
Instructor responsible for module	Dr. Edgar Skvorcov
Lecturer	Dr. Edgar Skvorcov
Language of instruction and examination	**Use in other study programs**
German	B.Eng. Electrical Engineering for Sustainable and Renewable Energy

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
6nd semester 2nd theoretical study phase	Compulsory module	One semester	Once a year in summer semester

WORK AND EXAM PERFORMANCE

Participation requirements	Technical German 3 (Level B2.2)
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	150 hours
Contact hours per week (SWS)	4
Risk assessment for pregnant women and mothers	Green

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar, seminar-based teaching, exercise 4 SWS	Practical course project (report, survey, project, or field report)	

CONTENT, METHODS AND RESULTS

Course 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 learned.

Learning outcomes

Language Proficiency C1.1

- Spoken interaction
- Students can discuss the results of their analysis of a technical text
- Students can define technical terms and build argumentation structures appropriate to the target audience.
- Students can present a complex topic in an appropriate, clear and well-structured way, prioritising the most important points

Reading Comprehension

- Students can understand long and complex instructions or directions that go beyond own field of specialisation or inter-est when difficult sections are read several times
- Students can analyse the subject-specific nature of relevant genres and conventions of scientific writing in technical texts.
- Students can understand detailed scientific reports, analyses and commentaries in which contexts, opinions and points of view are discussed

Written production

- Students can write about complex technical issues through the textual combination of language and image in technical contexts.
- Students can refer to arguments from the research literature (various sources) in their own scientific text and weigh them up against each other
- Students can present their own point of view on a research topic, highlighting main ideas and use examples to give reasons for their arguments.

Teaching and learning methods

Reading list
• Bräuer, Gerd. 2023. Literacy Management als Schlüsselkompetenz in einer digitalisierten Welt: Ein Arbeitsbuch für Schreibende, Lehrende und Studierende. Opladen, Berlin, Toronto: Barbara Budrich. • 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] • *Gemeinsamer Europäischer Referenzrahmen für Sprachen*: lernen, lehren, beurteilen. Begleitband. 2020. Stuttgart: Klett, ISBN 978-3-12-676999-0. [03.04.25] • 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. • 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]. Subject-specific learning materials will be provided in the course.

Elective Subject 1

(Automation and Robotics, B.Eng., SPO 2025)

Summary	One module must be selected from a list of modules relating to Automation and Robotics.		
Instructor responsible for module	Specified in the Academic and Examination Regulations (SPO)		
Lecturer	NN		
Language of instruction and examination	**Use in other study programs**		
English or German	B.Eng. Mechanical Engineering B.Eng. Digital Business Models and Technologies B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
5th term 3rd theoretical study phase	Elective module	One term	Once a year in winter term
WORK AND EXAM PERFORMANCE			
Participation requirements			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Contact hours per week (SWS)	4		
Risk assessment for preg-nant women and mothers			

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar, seminar-based teaching, exercise, internship 4 SWS	The course offerings are determined by the Faculty Council at the end of the current semester for the following semester. Eligible are three modules. Type, scope, and any admission requirements are specified in the Academic and Examination Regulations (SPO)	
CONTENT, METHODS AND RESULTS		
Course content		
The contents of each module can be found in a separate description.		
Learning outcomes		
Teaching and learning methods		
Reading list		

Elective Subject 2

(Automation and Robotics, B.Eng., SPO 2025)

Summary	One module must be selected from a list of modules relating to Automation and Robotics.		
Instructor responsible for module	Specified in the Academic and Examination Regulations (SPO)		
Lecturer	NN		
Language of instruction and examination	**Use in other study programs**		
English or German	B.Eng. Mechanical Engineering B.Eng. Digital Business Models and Technologies B.Eng. Electrical Engineering for Sustainable and Renewable Energy B.Eng. Engineering Physics		
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
6th term 3rd theoretical study phase	Elective module	One term	Once a year in summer term
WORK AND EXAM PERFORMANCE			
Participation requirements			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Contact hours per week (SWS)	4		
Risk assessment for preg-nant women and mothers			

Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar, seminar-based teaching, exercise, internship 4 SWS	The course offerings are determined by the Faculty Council at the end of the current semester for the following semester. Eligible are three modules. Type, scope, and any admission requirements are specified in the Academic and Examination Regulations (SPO)	

CONTENT, METHODS AND RESULTS
Course content
The contents of each module can be found in a separate description.
Learning outcomes
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Third practical Study Phase – Semester 7

Industrial Internship

(Automation and Robotics, B.Eng., SPO 2025)

Summary	Practical semester in an industrial company		
Instructor responsible for module			
Lecturer			
Language of instruction and examination	**Use in other study programs**		
German or English			
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
7th term 4th practical study phase	Compulsory module	One term	Once a year in winter term
WORK AND EXAM PERFORMANCE			
Participation requirements			
ECTS-Credits	25 ECTS		
Factor of calculation towards degree grade	0		
Workload	20 weeks full time in a company		
Contact hours per week (SWS)	0		
Risk assessment for preg-nant women and mothers			
Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**	
Internship	Practical report		
CONTENT, METHODS AND RESULTS			
Course 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. develo-pment, design, project planning, production, production preparation and control, quality management, optimisation of technical processes.			

Learning outcomes
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Industrial Internship accompanying Seminar 1

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The seminar provides foundations in scientific work, literature research, information processing, presentation techniques, and the preparation of technical reports and Bachelor's theses.
Instructor responsible for module	
Lecturer	
Language of instruction and examination	**Use in other study programs**
German	-

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
7th term 4th practical study phase	Compulsory module	One term	Once a year in winter term

WORK AND EXAM PERFORMANCE	
Participation requirements	
ECTS-Credits	3 ECTS
Factor of calculation towards degree grade	0
Workload	Overall workload: 112.5 hours, comprising • 37.5 hours classroom study • 75 hours self-study
Contact hours per week (SWS)	3
Risk assessment for preg-nant women and mothers	

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar, seminar-based teaching, exercise 3 SWS	Oral or written exam, 15min (oral) oder 60min (written)	

CONTENT, METHODS AND RESULTS
Course 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.

Learning outcomes
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Industrial Internship accompanying Seminar 2

(Automation and Robotics, B.Eng., SPO 2025)

Summary	The seminar provides foundations in project management, including project planning and control, teamwork and collaboration, risk management, communication skills, and the application of both classical and agile project management methods.
Instructor responsible for module	
Lecturer	
Language of instruction and examination	**Use in other study programs**
German	-

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
7th term 4th practical study phase	Compulsory module	One term	Once a year in winter term

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	2 ECTS
Factor of calculation towards degree grade	0
Workload	Overall workload: 75 hours, comprising ▪ 22.5 hours classroom study ▪ 52.5 hours self-study
Contact hours per week (SWS)	2
Risk assessment for pregnant women and mothers	

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
Seminar, seminar-based teaching, exercise 2 SWS	Oral or written exam, 15min (oral) oder 60min (written)	

CONTENT, METHODS AND RESULTS
Course content
The seminar deals with project management: basic project management methods and their application, consistent planning and work on projects in a team, collab-oration skills and working techniques, social skills. From the idea to the clarified assignment, project influences, roles in project management, cooperation in pro-jects, 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.
Learning outcomes
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Fourth Study Phase Final Thesis – Semester 8

<table>
<tr><td colspan="4"><h2>Elective Subject 3</h2>(Automation and Robotics, B.Eng., SPO 2025)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Summary</td><td colspan="3">One module must be selected from a list of modules relating to Automation and Robotics.</td></tr>
<tr><td>Instructor responsible for module</td><td colspan="3">Specified in the Academic and Examination Regulations (SPO)</td></tr>
<tr><td>Lecturer</td><td colspan="3">NN</td></tr>
<tr><td>Language of instruction and examination</td><td colspan="3">Use in other study programs</td></tr>
<tr><td>English or German</td><td colspan="3"></td></tr>
<tr><td>Semester and study phase</td><td>Module category</td><td>Duration of module</td><td>Frequency of module offer</td></tr>
<tr><td>8th term
4th study phase</td><td>Elective module</td><td>One term</td><td>Once a year in summer term</td></tr>
<tr><td colspan="4">WORK AND EXAM PERFORMANCE</td></tr>
<tr><td>Participation requirements</td><td colspan="3"></td></tr>
<tr><td>ECTS-Credits</td><td colspan="3">5 ECTS</td></tr>
<tr><td>Factor of calculation towards degree grade</td><td colspan="3">2</td></tr>
<tr><td>Workload</td><td colspan="3">Overall workload: 150 hours, comprising
▪ 45 hours lectures
▪ 105 hours self-study</td></tr>
<tr><td>Contact hours per week (SWS)</td><td colspan="3">4</td></tr>
<tr><td>Risk assessment for preg-nant women and mothers</td><td colspan="3"></td></tr>
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Type and scope of the course Examination method/	Examination method/ Requirements for the allocation of credit points	Approved examination aids
Seminar, seminar-based teaching, exercise, internship 4 SWS	The course offerings are determined by the Faculty Council at the end of the current semester for the following semester. Eligible are three modules. Type, scope, and any admission requirements are specified in the Academic and Examination Regulations (SPO)	
CONTENT, METHODS AND RESULTS		
Course content		
The contents of each module can be found in a separate description.		
Learning outcomes		
Teaching and learning methods		
Reading list		

Engineering Project

(Automation and Robotics, B.Eng., SPO 2025)

Summary	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.		
Instructor responsible for module			
Lecturer			
Language of instruction and examination	**Use in other study programs**		
Deutsch			
Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
8th term 4th degree study phase	Compulsory module	One term	Each term

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	10 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 300 h (project work)
Contact hours per week (SWS)	0,2
Risk assessment for pregnant women and mothers	

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
As part of the Engineering Project, faculty members from the university provide guidance. 0,2 SWS	Scientific report	

CONTENT, METHODS AND RESULTS

Course content
▪ Project organization and structuring ▪ Literature research ▪ Methodical knowledge acquisition ▪ Scientific evaluation and documentation
Learning outcomes
Teaching and learning methods
Reading list

Bachelor Colloquium

(Automation and Robotics, B.Eng., SPO 2025)

Summary	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.
Instructor responsible for module	
Lecturer	
Language of instruction and examination	**Use in other study programs**
English	

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
8th term 4th degree study phase	Compulsory module	One term	Each term

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	3 ECTS
Factor of calculation towards degree grade	1
Workload	Overall workload: 90 hours
Contact hours per week (SWS)	0
Risk assessment for preg-nant women and mothers	

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
	Presentation	

CONTENT, METHODS AND RESULTS

Course content
▪ Summary of engioneering and scientific results ▪ Designing and structuring a presentation, using suitable media ▪ Rhetoric in a professional context ▪ Discussion of scientific methods and expert knowledge
Learning outcomes
Student can summarize and communicate the motivation, methodology, and key engineering and scientific results of a Bachelor thesis in a clear and structured manner. They can design and deliver professional presentations using appropriate media, apply effective rhetorical techniques, and confidently defend their work in discussions with experts and peers. Furthermore, students demonstrate their ability to critically discuss scientific methods and subject-specific knowledge, respond to questions competently, and incorporate feedback for continuous improvement and future projects.
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Bachelor Thesis

(Automation and Robotics, B.Eng., SPO 2025)

Summary	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.
Instructor responsible for module	
Lecturer	
Language of instruction and examination	**Use in other study programs**
English or German	

Semester and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
8th term 4th degree study phase	Compulsory module	One term	Each term

WORK AND EXAM PERFORMANCE

Participation requirements	
ECTS-Credits	12 ECTS
Factor of calculation towards degree grade	5
Workload	Overall workload: 360 hours (project work)
Contact hours per week (SWS)	
Risk assessment for preg-nant women and mothers	

Type and scope of the course **Examination method/**	**Examination method/** **Requirements for the allocation of credit points**	**Approved examination aids**
	Bachelor's Thesis	

CONTENT, METHODS AND RESULTS

Course content
▪ Project organization and structuring ▪ Literature research ▪ Methodical knowledge acquisition ▪ Scientific evaluation and documentation
Learning outcomes
Students can independently plan, organize, and structure an engineering project while working on a practical problem in an industrial environment. They can conduct systematic literature research, acquire and apply relevant technical and methodological knowledge, and develop well-founded solutions to engineering challenges. Furthermore, they demonstrate the ability to scientifically evaluate, document, and present project results in a clear and professional manner.
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