COBURG
UNIVERSITY
of applied sciences and arts

MODUL MANUAL

Mechanical Engineering (BEng)

Valid für Study and examination regulations (SPO) 2025
15-04-2025

CONTENT

ABBREVATIONS

BEng	Bachelor of Engineering
ECTS	European Credit Transfer System
S	Summer term
SWS	Semester periods per week
W	Winter term

1. PROFILE OF THE BACHELOR´S PROGRAM

The Bachelor's degree program in Mechanical Engineering offers a sound education in all of the fundamental principles of mechanical engineering, combined with specialized knowledge in product and technology development as well as computer-aided simulation techniques. You will acquire comprehensive knowledge in the fields of mechanics, thermodynamics, materials science and production engineering. The focus on development enables you to design and implement innovative solutions for technical challenges. Through practical projects and laboratory work, you will learn how to use modern software tools to simulate physical-technical processes in order to optimize design decisions and increase product efficiency. The degree program promotes interdisciplinary thinking, creativity and teamwork by encouraging you to work together in group projects and present your ideas to experts. As a graduate in Mechanical Engineering, you will be well prepared for a career in a dynamic technical environment such as the automotive industry, aerospace, traditional mechanical engineering as well as research and development departments – all doors related to mechanical engineering are open to you! You will find a wide range of employment opportunities as development engineers, simulation specialists or project managers in various branches of industry and will ultimately be a sought-after specialist with both technical expertise and creative problem-solving skills.

2. MODULE STRUCTURE

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3. MODULE DESCRIPTIONS

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

1 Introduction to Advanced Mathematics

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
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
Semester periods per week (SWS)	4
CONTENT	

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

2 Scientific Basics

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
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
Semester periods per week (SWS)	4
CONTENT	

Course content
Physical quantities and their units ▪The International System of Units ▪Physical constants of nature ▪Dealing with very small / large values, prefixes Basics of experimentation ▪ Planning and conducting experiments ▪ Observation and data collection ▪ Evaluation, conclusion and documentation The Structure of atoms ▪ Structure of atomic nuclei und nuclear reactions ▪ Bohr's atomic model ▪ Atomistic interpretation of physical effects Chemical and physical bonding ▪ Energetically stable atoms and the octet rule ▪ Ionic and metallic bond ▪ Covalent bond (electron pair bond) ▪ The van der Waals interaction, hydrogen bond The states of matter ▪ Solids, liquids, gases and plasma state ▪ The change of the aggregte state, phase diagrams ▪ Mixtures of substances ▪ Some selected physical properties of matter Chemical reactions and stoichiometry ▪ Reaction equation, law of conservation of mass ▪ Exothermic and endothermic reactions

3 Academic English Skills

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,25
Workload	Overall workload: 150 hours, comprising: ▪ 60 hours online lecture ▪ 90 hours self-study
Semester periods per week (SWS)	4
CONTENT	

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.

4 Soft Skills and Culture

(Mechanical Engineering, BEng, SPO 2025)

Summary			
Language of instruction and examination	**Use in other study programs**		
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
1st term 1st theoretical study phase	Compulsory module	One term	Once a year in winter term
WORK PERFORMANCE			
ECTS-Credits	3 ECTS		
Factor of calculation towards degree grade	0,25		
Workload			
Semester periods per week (SWS)	2		
CONTENT			
Course content			

5 German Basics 1 (Level A1)

(Mechanical Engineering, BEng, 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)
Language of instruction and examination	**Use in other study programs**
German and English	BA Automation and Robotics BA Digital Business Models and Technologies BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,25
Workload	
Semester periods per week (SWS)	6
CONTENT	

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. 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). 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 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.

6 German Basics 2 (Level A2)

(Mechanical Engineering, BEng, SPO 2025)

Summary	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)
Language of instruction and examination	**Use in other study programs**
German and English	BA Automation and Robotics BA Digital Business Models and Technologies BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	7 ECTS
Factor of calculation towards degree grade	0,25
Workload	
Semester periods per week (SWS)	12
CONTENT	

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. 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. 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 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.

7 Technical Mathematics 1

(Mechanical Engineering, BEng, SPO 2025)

Summary	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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
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
Semester periods per week (SWS)	6

CONTENT

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)

8 Technical Mathematics 2

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

Term 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 PERFORMANCE	
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
Semester periods per week (SWS)	6
CONTENT	

Course content
▪ First-Order Ordinary Differential Equations ▪ Higher-Order Linear Ordinary Differential Equations ▪ Vector Calculus (Multiple Integrals, Total Differential) ▪ Partial Differential Equations ▪ Systems of Linear Differential Equations ▪ Fundamentals of Numerical Integration

9 Mechanics 1

(Mechanical Engineering, BEng, SPO 2025)

Summary	▪ 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

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

10 Mechanics 2

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

Term 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 PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

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 o Definition of angular momentum o Torque set, the moment of inertia and Steiner's theorem ▪ The general plane movement, rolling processes Definition of Work, Energy, Power Meaning and simple formulas of these physical quantities

11 Engineering Design 1

(Mechanical Engineering, BEng, SPO 2025)

Summary	The course teaches the basics of technical drawing and combines these with an introduction to design using CAD.		
Language of instruction and examination	**Use in other study programs**		
English	-		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
2nd term 2nd theoretical study phase	Compulsory module	One term	Once a year in summer term
WORK PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			

Course content
Design Content: ▪ Freehand Drawing ▪ Views, Projections, Sections ▪ Drawing Organization, Standards ▪ Dimensioning ▪ Representation of Standard Parts ▪ Surfaces ▪ Tolerances / Fits ▪ Geometric and Positional Tolerances ▪ Design Principles CAD Content: ▪ Parametric Associative Modeling ▪ Sketch Creation ▪ Reference Elements ▪ Part Modeling ▪ Assemblies ▪ Drawings

12 Machine Elements 1

(Mechanical Engineering, BEng, SPO 2025)

Summary	This module introduces students to the systematic design of essential components used in mechanical engineering. It covers fundamental design principles, guidelines, and best practices. Furthermore it provides fundamental knowledge about the design, function, and application of essential machine elements. The focus is on understanding the mechanical behavior, calculation, and selection of machine elements commonly used in engineering applications.
Language of instruction and examination	**Use in other study programs**
English	-

Term 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 PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
1. Design Theory ▪ Design rules, principles, and guidelines 2. Strength Calculations ▪ Stress analysis and failure criteria 3. Selection and Calculation of Machine Elements ▪ Springs ▪ Screws ▪ Rivets ▪ Pins, Bolts, and Locking Elements ▪ Shafts and Axles

13 Fundamentals of Electrical Engineering

(Mechanical Engineering, BEng, 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.		
Language of instruction and examination	**Use in other study programs**		
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
2nd term 2nd theoretical study phase	Compulsory module	One term	Once a year in summer term
WORK PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			

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.

14 Programming

(Mechanical Engineering, BEng, SPO 2025)

Summary			
Language of instruction and examination	**Use in other study programs**		
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
2nd term 2nd theoretical study phase	Compulsory module	One term	Once a year in summer term
WORK PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			

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 Modules and Libraries Using and creating modules, working with packages (e.g. pip)

15 Fundamentals of Business Administration

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	-

Term 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 PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

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

16 Materials Science and Technology

(Mechanical Engineering, BEng, SPO 2025)

Summary	Many technical innovations today are achieved due to advances in Materials Design and Engineering. Materials Science will be introduced in this module as the foundation of all technical products. Manufacturing methods and processes, as well as the testing and analysis procedures required to select and characterize technical materials are presented. Focus will be given to metallic and polymer materials.		
Language of instruction and examination	**Use in other study programs**		
English	-		
Term 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 PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			
Course content			
▪ Classification of materials - Structure of material and bond types ▪ Properties and modification of technical materials - e.g., strengthening mechanisms of metals and viscous behavior of polymers ▪ Manufacture, refining, and processing of technical materials - e.g., heat treatment and alloying of metal and injection molding of polymers ▪ Material testing ▪ Selected testing to deepen the understanding of material behavior and gain hands-on experience			

17 German Basics 3 (Level B1.1)

(Mechanical Engineering, BEng, 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)
Language of instruction and examination	**Use in other study programs**
German and English	BA Automation and Robotics BA Digital Business Models and Technologies BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,5
Workload	
Semester periods per week (SWS)	4
CONTENT	

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.

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 material:

Kurs DaF B1. Deutsch für Studium und Beruf, Kurs- und Übungsbuch. 2025. KLETT: ISBN 978-3-12-676842-9.

Kurs DaF B1. Deutsch für Studium und Beruf Kurs- und Übungsbuch. 2024. Hybride Ausgabe allango, KLETT.

18 Technical German (Level B1.2)

(Mechanical Engineering, BEng, 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)
Language of instruction and examination	**Use in other study programs**
German and English	BA Automation and Robotics BA Digital Business Models and Technologies BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

Term 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 PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	0,5
Workload	
Semester periods per week (SWS)	4
CONTENT	

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. Language Proficiency B1.2 Spoken interaction ▪ I can talk about everyday topics or more specialised topics from my own subject domain in an understandable way and give an opinion. ▪ I can give and explain short, simple technical information, tasks or problems. ▪ I can present information and ideas in a comprehensible way and use simple arguments to support them. Reading Comprehension ▪ I can understand the content of detailed instructions and assignments (e.g. the task of selecting specific information from a specialised text). ▪ I can take relevant information from short specialised texts for lectures and seminars. ▪ I can understand information for instruments and methods in my technical subject area when it is read repeatedly. Written production ▪ I can take notes from basic articles or contributions on common specialised topics of general interest. ▪ I can write simple texts (e.g. descriptions of experiments) on everyday topics and on more specialised topics from my own subject domain. ▪ 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 material: Kurs DaF B1. Deutsch für Studium und Beruf, Kurs- und Übungsbuch. 2025. KLETT: ISBN 978-3-12-676842-9. Kurs DaF B1. Deutsch für Studium und Beruf Kurs- und Übungsbuch. 2024. Hybride Ausgabe allango, KLETT. Subject-specific learning materials will be provided in the course.

19 Mathematical Applications

(Mechanical Engineering, BEng, SPO 2025)

Summary	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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 contact hours ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

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 Modeling and Simulation ▪ Physical Modeling with Differential Equations ▪ Monte Carlo Methods ▪ Stochastic Simulations and Random Processes

20 Simulation Methods 1

(Mechanical Engineering, BEng, SPO 2025)

Summary	This module introduces students to the practical application of numeri-cal methods in engineering, focusing on Computational Fluid Dynamics (CFD) and the Finite Element Method (FEM). It covers both theoretical foundations and hands-on computational exercises relevant to fluid mechanics and structural mechanics.		
Language of instruction and examination	**Use in other study programs**		
English	-		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
5th term 3rd theoretical study phase	Compulsory module	One term	Once a year in winter term
WORK PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			

Course content
In the area of Computational Fluid Dynamics (CFD), students will: ▪ Apply the continuity equation (conservation of mass) in differential form and simplify it for spe-cific engineering applications. ▪ Apply and interpret the momentum equation in differential form, with a clear understanding of each term's physical significance. ▪ Understand the principles of the finite volume discretization method, which forms the basis for modern CFD solvers. ▪ Gain a qualitative understanding of turbulence modeling and distinguish between different turbu-lence models and their applications. In the area of the Finite Element Method (FEM), students will: ▪ Formulate elastostatic problems using the finite element method. ▪ Apply material laws and local equilibrium conditions to derive element equations for structural analysis. For both CFD and FEM approaches, students will also: ▪ Generate appropriate meshes for the solution domain. ▪ Define and implement suitable boundary conditions. ▪ Perform postprocessing to evaluate and interpret results based on problem-specific objectives. Through this module, students develop the ability to apply numerical methods to solve real-world engineering problems using simulation tools and computational techniques.

21 Simulation Methods 2

(Mechanical Engineering, BEng, SPO 2025)

Summary	The changes of state of dynamic systems from the fields of mechanics, electrical engineering, economics or ecology are described mathe-matically by differential equations. These equations usually cannot be solved analytically, but only numerically. The course teaches the representation of dynamic systems suitable for simulation and their implementation in simulation systems. Simple systems can be modelled using routines in Python and Matlab, but the focus is on signal flow-based modelling with Matlab/Simulink. An insight into the modern approach of acausal equation-based modelling of dynamic systems complements the consideration of simulation approaches. Basic knowledge of the analysis of dynamic systems and the numerical solution of ordinary differential equations is taught to the extent required for the competent use of simulation tools.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
Representation of dynamic systems ▪ Differential equation systems ▪ State space representation of dynamic systems Implementation of simulation models ▪ Simple systems with Matlab and Python ▪ Implementation of signal flow-based system models in Matlab/Simulink ▪ Configuration and initialisation of dynamic systems ▪ Discontinuous system behaviour and re-initialisation ▪ Basics of state machines and StateFlow ▪ Introduction to physical modelling Mathematical basics ▪ System analysis, equilibrium states, stability ▪ Fundamentals of the numerical solution of differential equations

22 Strength of Materials

(Mechanical Engineering, BEng, SPO 2025)

Summary	▪ Students can calculate the linear-elastic deformation of rods, torsion bars, and bending beams and determine the resulting stress states. ▪ Students can solve statically indeterminate problems involving rods, torsion bars, and bending beams using superposition of self-constructed partial load cases. ▪ Students perform tensor transformations for the stress tensor, strain tensor, and area moment of inertia tensor both graphically (using Mohr's circle) and computationally. ▪ Students can determine and interpret the eigenvalues of the mentioned tensors. ▪ Students can calculate strain and mechanical stress fields from given displacement fields. ▪ Students can transform stress and deformation fields into each other for a linear-elastic material. ▪ Students master and understand the application of energy principles in structural mechanics. ▪ Students understand the fundamentals of the Finite Element Method in elastostatics. ▪ Students are familiar with the basics of using commercial Finite Element software.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
▪ Matrix Calculations / Determinants / Eigenvalue Problems ▪ Multiaxial Stress State / Mohr's Circle ▪ Multiaxial Displacement Fields ▪ Energy Principles (Virtual Work, Castigliano's Theorem, Ritz Method) ▪ Element Stiffness Matrices / Shape Functions ▪ Boundary Conditions in Finite Elements ▪ Material Matrices ▪ Boolean Assignment Matrices ▪ Practical Exercises with Ansys Workbench

23 Advanced Dynamics

(Mechanical Engineering, BEng, SPO 2025)

Summary	Technical mechanical systems can be quite complex in terms of their structure and motion states. As a rule, bodies are coupled together and form a multi-body system. Assemblies or individual bodies can also collide; impact processes are deliberately induced or happen accidentally and require special consideration due to a very short interaction time. It is possible that questions may arise in the context of development tasks that only concern the relationship between the position and velocity of bodies. The work or energy theorem is a practicable method for solving such time-free issues. In practice, oscillations often occur. Depending on the type of vibration excitation and the damping of the system, an oscillatory motion can develop to a greater or lesser extent. Finally, it may be possible to consider complex trajectory curves by superimposing fundamental forms of movement; here the mathematical description in e.g. rotating reference systems can be advantageous.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
Energy balance of mechanics: Work and energy theorem Relationship between position and speed for solving time-free issues ▪ Definition of physical work ▪ Kinetic and potential energy, conservative forces ▪ Gravitational and elastic potential Impulse and impact processes Simple physical and mathematical modeling of impact processes ▪ The momentum and angular momentum theorem ▪ Description of impact processes ▪ Rotary impacts and eccentric impacts Multibody systems with one degree of freedom Description and calculation of mechanical systems with coupled bodies ▪ Kinematic and physical bonds ▪ Mass point systems and rigid body systems o Force an torque equations o Application of the work and energy theorem ▪ The reduced mass moment of inertia One-dimensional oscillating systems Mathematical description of harmonically oscillating bodies systems ▪ Free oscillations (The harmonic oscillator) ▪ Viscose damping of systems ▪ Harmonic vibration excitation, resonance effect Relative kinematics, in particular rotating reference systems Description of the movement of points in moving reference systems

24 Scientific Work and Lab Workshops

(Mechanical Engineering, BEng, SPO 2025)

Summary	Gaining scientific knowledge through experiments requires a structured way of working. First of all, it is necessary to deal with the relevant theoretical principles in sufficient detail. The experiment itself must be well planned and prepared. When carrying out the experiment, care must be taken to ensure constant framework conditions and precise recording. Finally, the measurements must then be evaluated in a scientifically correct manner and recorded together with the description of the experiment and the interpretation of the results in a factually compact documentation.		
Language of instruction and examination	**Use in other study programs**		
English	-		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
6th term 3rd theoretical study phase	Compulsory module	One term	Once a year in summer term
WORK PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	0		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures and experiments ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			

Course content
Basics of scientific work ▪ Information procurement and processing ▪ Planning and conducting experiments ▪ Evaluation and presentation of measurement data ▪ Structuring and design of a scientific report Experiments from the following areas: ▪ Manufacturing processes ▪ Plastics processing ▪ Fluid technology ▪ Measurement technology

25 Engineering Design 2

(Mechanical Engineering, BEng, SPO 2025)

Summary	The course teaches the engineer's methodical approach to any task. This includes defining the task more precisely, identifying key issues, and possible solutions. The CAD component includes in-depth work-flows and the modeling of movable assemblies.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
Design Systematics Content: ▪ Model Capture ▪ Methodology vs. Intuition ▪ VDI 2221 ▪ What Does the Customer Want / Kano Diagram ▪ Functions and Function Structure ▪ Finding and Selecting Principle Solutions, Evaluation Methods ▪ Product Architecture ▪ Variation Principles ▪ Design Rules CAD Content: ▪ Kinematic systems ▪ Dynamic systems ▪ Joints ▪ Collision behavior ▪ Sensors, actuators ▪ Time- and event-driven simulation

26 Machine Elements 2

(Mechanical Engineering, BEng, SPO 2025)

Summary	The module provides essential knowledge and skills for the selection and analytical design of fundamental mechanical components. It covers the systematic assessment and dimensioning of shaft-hub connections, couplings, rolling and sliding bearings, and gearboxes. In addition, the design of installation sites for mechanical elements and standardized assemblies is addressed. The acquired knowledge is applied through the development of own concepts and solutions within given design tasks, always considering established design principles and standards.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
This module covers the fundamentals for the selection, dimensioning, and design of key mechanical elements commonly used in mechanical engineering. The focus is on: ▪ shaft-hub connections, such as: o positive (form-fitting) connections: key joints (e.g., parallel keys) o frictional (force-fitting) connections: interference fits (e.g., longitudinal press fit, transverse press fit) ▪ couplings and brakes, including: o switchable and non-switchable couplings o rigid, torsionally rigid, and torsionally flexible couplings ▪ rolling and sliding bearings, comprising: o rotational bearings (e.g., ball and roller bearings) o linear guides (e.g., linear sliding bearings, linear rolling bearings) ▪ gear units, such as: o gear transmissions (e.g., spur gear units) o belt drives (e.g., flat belt, V-belt, and toothed belt drives) In addition to the analysis and design of these components, the module also covers the design of installation sites for mechanical elements and standardized assemblies. The acquired knowledge is applied through the completion of predefined design tasks, which allow for the development of individual concepts and solutions.

27 Digitalization of Production

(Mechanical Engineering, BEng, SPO 2025)

Summary	This module provides the fundamentals, opportunities, and benefits of digitalization in companies, focusing on processes along the value chain, especially in production. Large amounts of data can be collected and analyzed within these processes and across the entire product life cycle. The course examines the potential and innovative power of this data and highlights the interaction of humans, machines, and proces-ses in dynamic, digitally connected production value chains.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4

CONTENT

Course content

▪ Fundamentals of digitalization of production and digital value chains
▪ Introduction to Industry 4.0 and other worldwide concepts and approaches
▪ Fundamentals of Internet of Things (IoT) and Cyber-Physical Systems (CPS)
▪ Data, information, and knowledge as central elements of digitalization in production
▪ Approaches of Big Data, Data Analytics, and Cloud Computing
▪ Human Aspects in Digitalization of Production

28 Control Engineering

(Mechanical Engineering, BEng, 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.		
Language of instruction and examination	**Use in other study programs**		
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
4th term 3rd theoretical study phase	Compulsory module	One term	Once a year in summer term
WORK PERFORMANCE			
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		
Semester periods per week (SWS)	4		
CONTENT			

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

29 Fluid Mechanics

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
Students will be able to: ▪ Analyze hydrostatic systems: o Calculate pressure o Determine forces and moments ▪ Apply core fluid mechanics equations: o One-dimensional continuity equation for pipe flows o Steady and unsteady energy equation (Bernoulli equation) o Momentum conservation theorem to calculate forces and moments in pipe systems ▪ Evaluate thermal systems: o Calculate heat transfer by conduction in simple configurations Students will understand: ▪ Fundamental fluid mechanics concepts: o Basic principles and hydrostatics o Fluid kinematics o Incompressible flows and streamline theory ▪ Governing equations: o Continuity equation o Energy equation (Bernoulli) o Momentum conservation theorem ▪ Flow behavior: o Fundamentals of viscous flows o Characteristics of laminar and turbulent flows o Pipe flow dynamics ▪ Heat transfer: o Basic conduction processes

30 Thermodynamics

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	

Course content
Students will be able to: ▪ Distinguish between: o State variables o Process variables ▪ Calculate: o Specific gas constants o State variables in the two-phase region o Properties of ideal gases and gas mixtures o Cyclic thermodynamic processes ▪ Understand and apply: o Phase diagrams o The first law of thermodynamics to closed and open systems o The second law of thermodynamics to various systems Students will understand: ▪ Concepts of: o System and state o Processes and process variables ▪ Thermodynamic principles: o First law of thermodynamics o Second law of thermodynamics ▪ Behavior of: o Ideal gases and their state variables o Gas mixtures, moist air, and steam ▪ Analysis of: o Phase diagrams o Cyclic processes in power-generating and work-absorbing machines o Selected adiabatic flow processes

31 Measurement Technology

(Mechanical Engineering, BEng, 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.
Language of instruction and examination	**Use in other study programs**
English	BA Automation and Robotics BA Electrical Engineering for Sustainable and Renewable Energy BA Engineering Physics

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 60 hours lectures/lab ▪ 90 hours self-study
Semester periods per week (SWS)	4
CONTENT	

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

32 Production Technology

(Mechanical Engineering, BEng, SPO 2025)

Summary	This module provides an overview of manufacturing and production technologies. The overview is based on DIN 8580, focussing on the individual manufacturing processes. In addition, the associated production tools and the required production machines are presented.		
Language of instruction and examination	**Use in other study programs**		
English	-		
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
5th term 3rd theoretical study phase	Compulsory module	One term	Once a year in winter term
WORK PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			
Course content			
▪ Basics of machining ▪ Machining with geometrically defined cutting edge (turning, milling, drilling etc.) ▪ Machining with geometrically indeterminate cutting edge (grinding, honing, lapping etc.) ▪ Primary shaping processes (casting, sintering); Forming processes (rolling, extrusion, forging, deep drawing, bending) ▪ Compare, assess and select suitable manufacturing processes, especially for the production of metallic workpieces ▪ Comparison of technologies and machine technology with regard to achievable accuracies and surface quality.			

33 Advanced Material Science

(Mechanical Engineering, BEng, SPO 2025)

Summary	Deepening the knowledge of all material groups, in particular their processing, test methods, and characterization. Acquiring skills for requirement-oriented selection of materials.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4
CONTENT	
Course content	
Advanced study of special materials: non-ferrous metals, semiconductors, composite materials, ceramics ▪ Effect of alloying elements in metals ▪ Introduction to corrosion ▪ Testing methods and fracture analysis ▪ Introduction to friction ▪ Special manufacturing processes ▪ Creep / relaxation	

34 Industrial Organization and Quality Management

(Mechanical Engineering, BEng, SPO 2025)

Summary	In this module, the targets of producing enterprises are pointed out. It is shown, how these different targets influence the organizational structures of prducing enterprises. Furthermore the influence of product and process quality on the targets of enterprises are figueres out. The role of quality management to achieve these targets are described.
Language of instruction and examination	**Use in other study programs**
English	-

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

WORK PERFORMANCE	
ECTS-Credits	5 ECTS
Factor of calculation towards degree grade	2
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study
Semester periods per week (SWS)	4

CONTENT

Course content

▪ targets of producing enterprises
▪ different forms of organization of enterprises
▪ process developement
▪ organization and total quality management (TQM)
▪ international standards and process modelling
▪ quality management during the product lifecycle
▪ quality and digitalization

35 Elective Subject 1

(Mechanical Engineering, BEng, SPO 2025)

Summary	One module must be selected from a list of modules relating to mechanical engineering.		
Language of instruction and examination	**Use in other study programs**		
English or German			
Term 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 PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			
Course content			
The contents of each module can be found in a separate description.			

36 Elective Subject 2

(Mechanical Engineering, BEng, SPO 2025)

Summary	One module must be selected from a list of modules relating to mechanical engineering.		
Language of instruction and examination	**Use in other study programs**		
English or German			
Term 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 PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			
Course content			
The contents of each module can be found in a separate description.			

37 Industrial Internship

(Mechanical Engineering, BEng, SPO 2025)

Summary	Practical semester in an industrial company		
Language of instruction and examination	**Use in other study programs**		
English			
Term 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 PERFORMANCE			
ECTS-Credits	25 ECTS		
Factor of calculation towards degree grade	0		
Workload	20 weeks full time in a company		
Semester periods per week (SWS)	0		
CONTENT			
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.			

38 Industrial Internship accompanying Seminar 1

(Mechanical Engineering, BEng, SPO 2025)

Summary	The seminar deals with introduction to scientific work, organisation of literature research, ability to process information		
Language of instruction and examination	**Use in other study programs**		
English	-		
Term 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 PERFORMANCE			
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		
Semester periods per week (SWS)	3		
CONTENT			
Course content			
Identification of topics and learning fields literature research, literature procurement, information preparation, presentations, practical report, Bachelor's thesis			

39 Industrial Internship accompanying Seminar 2

(Mechanical Engineering, BEng, SPO 2025)

Summary	The seminar deals with project management: basic project management methods and their application, consistent planning and work on projects in a team, collaboration skills and working techniques, social skills.		
Language of instruction and examination	**Use in other study programs**		
English	-		
Term 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 PERFORMANCE			
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		
Semester periods per week (SWS)	2		
CONTENT			
Course content			
From the idea to the clarified assignment, project influences, roles in project management, cooperation in projects, visions and goals, procedure and milestones, overview of all project tasks, planning and control-ling of projects, risk management, structure and preparation, classic PM and agile project management.			

40 Elective Subject 3

(Mechanical Engineering, BEng, SPO 2025)

Summary	One module must be selected from a list of modules relating to mechanical engineering.		
Language of instruction and examination	**Use in other study programs**		
English or German			
Term and study phase	**Module category**	**Duration of module**	**Frequency of module offer**
8th term 4th degree study phase	Elective module	One term	Once a year in summer term
WORK PERFORMANCE			
ECTS-Credits	5 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 150 hours, comprising ▪ 45 hours lectures ▪ 105 hours self-study		
Semester periods per week (SWS)	4		
CONTENT			
Course content			
The contents of each module can be found in a separate description.			

41 Engineering Project

(Mechanical Engineering, BEng, 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.		
Language of instruction and examination	**Use in other study programs**		
English			
Term 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 PERFORMANCE			
ECTS-Credits	10 ECTS		
Factor of calculation towards degree grade	2		
Workload	Overall workload: 300 h (project work)		
Semester periods per week (SWS)			
CONTENT			
Course content			
▪ Project organization and structuring ▪ Literature research ▪ Methodical knowledge acquisition ▪ Scientific evaluation and documentation			

42 Bachelor Colloquium

(Mechanical Engineering, BEng, 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.		
Language of instruction and examination	**Use in other study programs**		
English			
Term 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 PERFORMANCE			
ECTS-Credits	3 ECTS		
Factor of calculation towards degree grade	1		
Workload	Overall workload: 90 hours		
Semester periods per week (SWS)	0		
CONTENT			
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			

43 Bachelor Thesis

(Mechanical Engineering, BEng, 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.		
Language of instruction and examination	**Use in other study programs**		
English or German			
Term 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 PERFORMANCE			
ECTS-Credits	12 ECTS		
Factor of calculation towards degree grade	5		
Workload	Overall workload: 360 hours (project work)		
Semester periods per week (SWS)			
CONTENT			
Course content			
▪ Project organization and structuring ▪ Literature research ▪ Methodical knowledge acquisition ▪ Scientific evaluation and documentation			

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