Appendix B: Module catalogue

for the study programme Mechatronics/Automation (work-integrated) B.Eng.

Please note: The German version of this document is the legally binding version. The English translation provided here is for information purposes only.

Drive Technology					AT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3130	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, the students have understood the functional principle of a stepper motor and can explain the functionality in their own words. The students worked in small groups to understand the control principle of a stepper motor and gained their first practical experience in programming a control circuit for a stepper motor.
The students have understood the functional principle of a frequency inverter as well as a servo amplifier including servo motor and can describe the function in their own words. In addition, the students have gained a basic understanding of the design, adjustment and parameterisation of a drive.
The students have gained their first experience in the programming of function control applications and have implemented and practically tested their own programmes using common programming software.

3 Contents:

Stepper motor
- Design and operating principle
- Control and regulation

Frequency inverter and servo amplifier
- Rectifier
- DC link
- Pulse inverter Modulation method
- Communication interfaces to position encoders
- Current measurement
- Voltage measurement

Design, setting and parameterisation of drives
- Design of a drive
- Setting and parameterisation of drives

Motion Control
- Introduction
- PLC Motion Programming
- CNC programming with G-code
- Kinematics

Servo motors
- Structure
- Holding brake

	• Position transmitter	
4	Forms of teaching:	
	Learning units for self-study, classroom events in the form of exercises and practicals.	
5	Participation requirements:	
	Formal:	
	Content:	None
6	Forms of assessment:	
	Term paper, written examination or oral examination	
7	Prerequisite for the award of credit points:	
	Module examination pass and course assessment	
8	Application of the module (in the following study programmes)	
	Mechatronics /Automation (work-integrated) B.Eng.	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr.-Ing. Michael Leuer	
11	Other information:	
	Possible supplementary literature will be announced at the beginning of the course.	
12	Language:	
	German	

Bachelor Thesis					BA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3133	360 h	12	7th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	360	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	After successfully completing the bachelor thesis, students are able to independently work on and appropriately present a practice-oriented task from their special subject area, both in the subject-specific details and in the interdisciplinary contexts, using scientific methods within a specified period of time.	
3	Contents:	
	The bachelor thesis is an independent scientific work from the subject area of the respective study programme with a description and explanation of its solution. It can be derived from current research projects at the university or from operational problems with an engineering character. It can also be determined by an empirical investigation or by conceptual or design tasks or by an evaluation of existing sources. The different forms can be combined.	
4	Forms of teaching:	
	Written composition with faculty tutoring	
5	Participation requirements:	
	Formal:	-
	Content:	Coordinated topic from the student’s special subject area
6	Forms of assessment:	
7	Prerequisite for the award of credit points:	
8	Application of the module (in the following study programmes)	
	Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	N. N.	
11	Other information:	
	-	
12	Language:	
	German	

Digital Technology					DGT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3119	150	5	2nd semester or 6th semester	Annual (Summer) mester	1 semester

1	Course:	Planned group sizes	Scope		actual contact time / classroom teaching		Self-study	
	Lecture	60 students	1	SCH	0	h	32	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	3	SCH	24	h	70	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successfully completing the course, students know the basics of analysing and designing simple digital circuits. Students will be able to describe and classify the basic interrelationships in the field of digital technology and control technology. They are able to identify the benefits of digital systems in a problem-oriented manner and to select and develop solution approaches and strategies. The students can develop simple digital circuits to solve control engineering tasks from the various technical areas. Furthermore, they can justify and defend their solution to a given digital technology problem. The students know the basics of programmable logic circuits and FPGAs and their text-based description with selected hardware description languages.

3 Contents:

Introduction to Digital Technology

- Terms
- Definitions
- Number Systems
- Codes and Coding

Analysis and synthesis of circuits

- Basic and derived links
- Calculation rules of circuit algebra
- Description of logical functions
- Simplification of logical circuits
- Code converter

Rear derailleurs

- Bistable and monostable tilting stages
- Delay elements
- Astable tilt steps

Counter

- Asynchronous and synchronous counter design procedures

Programmable Logic Circuits (PLD)

- Introduction of PLDs
- Programming PLDs FPGAs
  Handware description languages

4 Forms of teaching:

	Learning materials for self-study, classroom sessions in the form of exercises.	
5	Participation requirements:	
	Formal:	None
	Content:	
6	Forms of assessment: Term paper, written examination, combination examination, performance exam or oral exam	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker	
11	Other information: Supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Documentation of Mechatronic Systems					DMS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3126	150 h	5	6th sem.	Annual (Summer) mester	1 semester

1	Course:	Planned group sizes	Scope		actual contact time / classroom teaching		Self-study	
	Lecture	60 students	1	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	3	SCH	24	h	54	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

The students know the high requirements for technical documentation and are able to create such documents. They know the legal framework of a CE marking and can create the requirements for awarding a CE mark.
They can prepare a legally sound hazard analysis of production processes and have knowledge of hazard prevention. They know the most important principles of the currently valid Machinery Directive as well as important safety standards and the Low Voltage Directive. They can draw up a specification sheet and, derived from it, a requirements specification and know the basic elements of product liability.

3 Contents:

- Fundamentals of machinery safety
- Harmonised European standards
- Conformity and presumption of conformity
- Machinery Directive
- Low Voltage Directive; Product Safety; EMC Directive
- Basics of Product Liability
- ISO 12100 "Safety of machinery"
- Protective devices: separating, non-separating, technical implementation
- Protective distances
- Basics of technical documentation:
- Specifications

4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises	
5	Participation requirements:	
	Formal:	
	Content:	
6	Forms of assessment: Term paper, written exam, combination exam, project work or oral exam	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Thomas Freund	
11	Other information: Necessary supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Introduction to the Professional Field					EIB
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3100	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	1	SCH	0	h	27	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	52	h
	Practical or seminar	15 students	1	SCH	16	h	23	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

The students learn about the origin and development of the job description as well as the fields of application of engineers in the field of mechatronics/ automation technology. To this end, they will gain an insight into the most diverse corporate divisions relevant to engineers and their tasks. In addition, they have an overview of basic types of mechatronic systems and automation systems, their structure and mode of operation as well as the special features in their development. Based on this basic knowledge, students learn the necessary technical and social competences of engineers in the field of mechatronics/automation technology and acquire a holistic picture of the occupational field.

3 Contents:

Job description, fields of work and development prospects for engineers in the field of mechatronics/automation technology:

- Basics of industrial enterprises (objectives, structure, types of enterprises, development and production)
- Tasks of engineers in industrial companies
- Knowledge of project-related working methods
- Communication in the company
- Management soft skills

Basic understanding:

- Automation technology: Task and realisation
- Mechatronic systems: Structure and mode of operation
- Planning, development and commissioning of technical systems
- Scientific work (presentation, scientific writing)

Industries for engineers in the field of mechatronics/automation technology

4 Forms of teaching:

Learning units for self-study, attendance events in the form of seminar-based lessons, exercises and excursions

5 Participation requirements:

Formal:	
Content:	

6 Forms of assessment:

Term paper, written examination, project work or exam accompanying the course

7 Prerequisite for the award of credit points:

	Module examination pass
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Dipl.-Ing. Vanessa Prott-Warner
11	Other information: Necessary additional literature will be announced at the beginning of the course.
12	Language: German

Electrical Machines					EM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3124	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self Study-	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, the students have understood the functional principle of the DC motor, the three-phase synchronous motor and the three-phase asynchronous motor. The students can describe the function of the respective motor types in a few words and describe the steady-state operating behaviour using the steady-state motor equations they have worked out. In addition, the students can select suitable operating points for controlling the motor.
The students practically tested and evaluated the operating behaviour of a DC motor in small groups. In addition, the students worked in small groups to understand the functional principle of an inverter for controlling a three-phase motor and to create the control programme of a three-phase inverter in a common programming environment and tested and evaluated it on a three-phase motor.

3 Contents:

Introduction to drive technology
- Tasks of drive technology
- Basic structure of an electric drive
- Materials for building electric motors
- Cooling of electrical drives
- Losses in electrical drives
- Basic electrotechnical laws
- Flow law
- Induction law
- Force action law

DC motor
- Structure and functional principle
- Modelling
- Stationary operating behaviour
- Operation on a buck converter

Three-phase inverter
- Inverter cirquit
- Pulse width modulation

Synchronous motor
- Structure and functional principle
- Modelling
- Stationary operating behaviour and operating point selection

Asynchronous motor

	• Structure and functional principle • Modelling • Operating behaviour	
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals.	
5	Participation requirements:	
	Formal:	
	Content:	None
6	Forms of assessment: Term paper, written examination, project work or oral examination	
7	Prerequisite for the award of credit points: Module examination pass and course assessment	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Michael Leuer	
11	Other information: Supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Electrical Measurement					EMT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3115	150 h	5	3rd or 4th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2	Learning outcomes/competences: The aim of the module is to acquire basic knowledge and its application about definitions, calculations and measurements of electrical measurands, their measurement errors as well as about the design of important electrical measuring devices.
3	Contents: General basics of measurement technology are taught in order to then work out the basics of electrical measurement, preferably of electrical measurands. Essential teaching contents are: • Basics of measuring electrical quantities • Definitions and calculations of time averages • Measurement deviations and measurement uncertainties • Structure, function and properties of analogue electrical measuring instruments • Digital storage oscilloscopes • Power and energy measurement • Differential arrangements • Measuring bridges
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written exam, project work or oral exam
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Thomas Freund
11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Electrical Engineering I					ELO1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3102	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	1	SCH	0	h	32	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	3	SCH	24	h	70	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

The students have basic knowledge of electrical engineering. The students are able to correctly understand and analyse physical relationships in electricity and to calculate simple circuits and networks for direct current circuits. In addition, they can solve simple field tasks in electrostatics.
They will also know the materials and designs of resistors and capacitors and how to use them in circuitry.
They know how to use homogeneous semiconductors as non-linear components in the DC circuit for required applications.

3 Contents:

- Basic terms and quantities in electrical engineering
- Derivation of the basic equations, Ohm's law
- Simple and branched DC circuits
- Methods for calculating DC circuits
- Electrical energy and electrical power
- The electrostatic field, manifestations and forces
- The capacitor, charging and discharging processes
- Structure and types of resistors and capacitors
- Homogeneous semiconductor components: LDR, PTC, NTC, VDR
- Nonlinear direct current circuits

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	

6 Forms of assessment:

Written examination, combination examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Mechatronics/Automation (work-integrated) B.Eng. and Product-Service Engineering (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. Werner Schwerdtfeger

11	Other information:
12	Language: German

Electrical Engineering II					ELO2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3105	150 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

The students have basic knowledge of electrical engineering. They are able to understand and analyse physical relationships in electricity and magnetism. With the help of complex calculation, they can also interpret and calculate demanding circuits from the AC range.
In addition, they can solve simple tasks on the magnetic field. They will also know the materials and designs of coils and transformators and know how to use them in terms of circuitry.

3 Contents:

- The static and time-variant magnetic field
- Calculation of magnetic circuits
- Induction law and inductance
- Basic concepts of alternating current technology
- Description of alternating variables with the aid of complex calculation
- Procedure for calculating alternating current circuits
- Locus curve and floor diagram
- Power in an AC circuit
- Improving the power factor
- The transformer
- Construction and designs of coils and transformers

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	-
Content:	

6 Forms of assessment:

Written examination, combination examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

8 Application of the module (in the following study programmes)

Mechatronics/Automation (work-integrated) B.Eng. and Product-Service Engineering (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. Werner Schwerdtfeger

11	Other information: -
12	Language: German

Fluid Power					FLT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3356	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students acquire knowledge of the design and function of the most common hydraulic and pneumatic components. They understand the basic hydraulic and pneumatic circuits and know the system behaviour.
They will be able to dismantle hydraulic and pneumatic components and dimension them.

3 Contents:

Fluids and fluid properties

- Pressurised fluids and compressed air

Fundamentals of fluid mechanics

- Continuity equation, pressure losses, inertia effect, compressibility

Components and parts

- Basic principle, power transmission and energy conversion
- Static system characteristic curve
- Valves
- Pneumatic linear and rotary actuators
- Electric sensors for fluid technology

Electrical control of the actuators and integration into PLC programmes

4 Forms of teaching:

Learning letters for self-study, attendance events in the form of exercises

5 Participation requirements:

Formal:	
Content:	

6 Forms of assessment:

Written examination, combination examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Mechatronics/Automation (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

N. N.

11	Other information:
12	Language: German

Functional Safety of Machines and Plants					FSMA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3358	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students are able to design, analyse and evaluate simple systems under safety-relevant aspects.
They can design and evaluate the safety architectures in hardware, software and mechanical machine parts.
The students have an overview of the effective structure of a safety management system and can take on the activity of a safety manager. They are able to navigate the basic applicable standards and understand their safety philosophy.

3 Contents:

General

- Hazard and risk analyses
- Presumption of conformity
- Characteristics for safety assessment
- Interrelationship of the characteristics
- Safety architectures
- Diagnostic capability and degree of coverage
- Fault consideration and fault control
- Calculation examples for determining the key figures

Hardware

- Typical failure assumptions (component failures, component behaviour under failure conditions, etc.) as well as the views of the standards
- Examples of: Input circuits, output circuits, logic units, combination in the overall system, error analysis
- Avoidance of systematic hardware errors
- Development models (V-model, waterfall, spiral, etc.)
- Review methods

Software

- Typical error assumptions (race conditions, memory accesses, etc.)
- Avoidance of systematic software errors
- Development models (V-model, waterfall, spiral, etc.)
- Reviews
- Software test methods (unit, integration and system tests)
- Evidence of test coverage

Security management

- Safety plan, validation and verification methods, document

	management inspection companies, system and safety specification, FMEA techniques, test instructions, change management, statistical recording and evaluation, etc.	
4	Forms of teaching: Learning materials for self-study, classroom sessions in the form of exercises.	
5	Participation requirements:	
	Formal:	
	Content:	
6	Forms of assessment: Term paper, written examination or oral examination	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: N. N.	
11	Other information:	
12	Language: German	

Fundamentals of Business Administration					GBW
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3132	150 h	5	1st or 3rd semester	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

The students know the basic organisational structures and the optimisation tasks of companies as well as the basic principles and success criteria of economic action. This enables them to classify their own engineering activities in the operational and business context and to assess and control the economic consequences/effects of their activities. In this sense, the module provides the basic business knowledge and the basic structures for interdisciplinary thinking and action.

3 Contents:

- Classification, development and basic concepts of business administration
- Basic principles of economic action
- Overview of the most important business functional areas at the level of goods management and finance as well as the cross-functional areas (materials management, production, sales, investment and financing, business accounting (annual financial statements, cost accounting))
- Corporate goals and corporate key figures/key performance indicator systems
  Forms of corporate law and corporate affiliations

4 Forms of teaching:

Self-study units, exercises and practicals in the form of face-to-face events

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Term paper, written examination, project work or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng. and Product-Service Engineering (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Economist Ulrike Franke

11	Other information: -
12	Language: German

Foundations of Computer Science					GDI
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3353	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successful completion of the module, students master the terminology of computer science and have basic knowledge of the functioning of computer systems and computer architectures. The students know selected methods for the description and evaluation of algorithms. They can structure simple information technology problems and develop suitable solutions, as well as justify and defend them. Students have basic knowledge and initial experience in the implementation of algorithms in the programming language C.

3 Contents:

Introduction to Computer Science:

- Terms
- Definitions
- Number systems
- Representation of numbers and characters in the computer
- Methods for describing algorithms with flow charts, Nassi–Shneiderman diagram and pseudo code
- Methods for evaluating the complexity of algorithms

Basics of computer architecture:

- Basic structure of processors
- Instruction cycle in microprocessors
- Memory hierarchy
- Bus systems

Programming in C:

- Conditional instructions
- Loops
- Functions
- Arrays
- Pointers
- Structs
- Working with files

Selected algorithms:

- Sorting algorithms (e.g. bubble sort and quick sort)
- Search algorithms (e.g. binary search)

4	Forms of teaching: Learning materials for self-study, classroom sessions of exercises and practicals	
5	Participation requirements:	
	Formal:	
	Content:	
6	Forms of assessment: Term paper, written examination, project work or oral examination	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng. and Product-Service Engineering (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker	
11	Other information:	
12	Language: German	

Basics of Mechanical Design					GDK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3253	150 h	5	4th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

The students know the basics of technical drawing, can understand technical drawings and execute simple technical representations. They understand the basic procedure in the design process, know the basics of methodical design and can thus contribute to the design of products. From the application of the fundamentals of strength, the students can recognise essential connections of stress-appropriate design and carry out their own selected strength verifications. They understand the general procedure for the selection of design and machine elements and are able to select different design elements from an understanding of the functional and stress concerns and dimension them.

3 Contents:

General principles of mechanical design:
Design methodology and systematics
Design of components and assemblies
Fundamentals of standardisation
Tolerances, fits, technical surfaces
Technical drawing (types of drawings, structure of technical drawings, representation of components, tolerance specifications in drawings, drawing specifications for technical surfaces)
Introduction to strength of materials:
Tasks of strength theory; external forces and internal stresses; basic types of stress; temporal load progression; strength parameters for material behaviour; influences on component strength; analytical strength calculation.
Selected machine and connecting elements:
Fasteners; bearing and transmission elements; exercises for creating and reading technical drawings as well as for the strength-compliant design of components and for strength verification.

4 Forms of teaching:

Learning units for self-study, attendance events in the form of lectures and exercises

5 Participation requirements:

Formal:	-
Content:	-

6	Forms of assessment: Term paper, written examination, combination examination, performance examination, project work, oral examination or examination during the course
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Product-Service Engineering (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Klaus Dürkopp
11	Other information: -
12	Language: German

Semiconductor Devices and Circuits					HBS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3255	150 h	5	3rd or 5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, students will be able to describe the operating behaviour of active and passive components of electronics in their own words. The students have understood the function of the components and can select suitable components for a corresponding application and determine the operating point by means of characteristic curve fields and the descriptive equations. In small groups, the students gained their first experience with measuring components and evaluating the results.
The students are able to interpret electronic circuits, understand the functional principle and determine the current and voltage curves in the circuits. In small groups, the students gained their first experience of calculation, design, construction and testing of basic electrical circuits.

3 Contents:

Semiconductor diodes
- Construction and designs
- Characteristic curves and values
- Circuit examples

Bipolar transistors
- Construction and designs
- Characteristic curves and values
- Circuit examples

Unipolar thyristors
- Construction and designs
- Characteristic curves and values
- Circuit examples

Operational amplifier (OPA)
- Functional principle
- Analogue OPA circuits

Optoelectronic components
- Semiconductor circuits
- Digital circuits
- Transistor as switch
- Toggle circuits
- Basic logic circuits

4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals.	
5	Participation requirements:	
	Formal:	
	Content:	
6	Forms of assessment: Term paper, written examination, combination examination or oral examination	
7	Prerequisite for the award of credit points: module examination pass and course assessment	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Michael Leuer	
11	Other information:	
12	Language: German	

Handling and Assembly Technology					HMT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3357	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

The students know handling functions and their technical realisation. They are able to evaluate handling tasks in the areas of production and assembly and to design automation solutions for them.
The students have a comprehensive, detailed and integrated knowledge of the automation of manufacturing and assembly processes.
They are familiar with flexible assembly systems from manual assembly to fully automatic assembly with varying flexibility.

3 Contents:

- Significance and development
- Fundamentals of VDI2860
- Handling objects
- Handling processes
- Function carriers and feeders
- Flexible handling technology (overview robotics)
- Transfer systems
- Feeding fluids and bulk solids
- Safety requirements
- Assembly technology

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises.

5 Participation requirements:

Formal:	
Content:	

6 Forms of assessment:

Written examination, oral exam or exam accompanying the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Mechatronics/Automation (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

N. N.

11 Other information:

-

12	Language: German

Industrial Communication					IKK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3127	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

The students know the ISO-OSI layer model and can classify different industrial fieldbuses. They know the importance of the individual layers and their role in industrial communication. They learn the importance of real-time systems and their technical background. They can match technological and technical boundary conditions of fieldbuses with technical requirements.
They know the advantages and disadvantages of network topologies and can assign these user requirements.

3 Contents:

The ISO-OSI layer model

1. Physical layer: Copper, fibre, radio, signal sampling and synchronisation
2. Data link layer: MAC & LLC, access procedures, multiplexing, protocols and their security, collision management, error detection and its correction, coding, redundancy, traffic shaping, function of bridges and switches
3. Network layer: Routing algorithms, addressing, connectionless and connection-oriented services, error identification, IP, DHCP, NAT, function of routers
4. Transport layer: Quality of Service (QoS); communication endpoints (socket), connection establishment and termination, TCP, UDP,
5. Session layer: Transaction security from unreliable channels
6. Presentation layer: Character representation, encoding, compression, zip, mpeg, jpg, png,..
7. Application layer: Application protocols and services, client-server models

Industrially used examples of layers 1 and 2:

- Synchronous and asynchronous BUS technologies
- Real-time communication capability
- Requirement of real-time systems
- Measures for the realisation of real-time
- Structure and usability of the Ethernet protocol
- Industrial fieldbuses: with own protocol
  - AS-Interface, CAN, CANOpen; Profibus, HART, ...
  - Measures for explosion protection
- Ethernet-based fieldbuses: EtherCAT, ProfiNet, ..
- Bus technologies with single master; multi-master and masterless buses

4	Forms of teaching: Learning units for self-study, attendance events in the form of exercises and practicals	
5	Participation requirements:	
	Formal:	None
	Content:	None
6	Forms of assessment: Term paper, written examination, project work or oral examination	
7	Prerequisite for the award of credit points: Module examination pass and course assessment	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Thomas Freund	
11	Other information: Supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Industrial Control Technology					IST
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3117	150 h	5	4th or 6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, the students have a basic knowledge of the essential components of an automation system and can select and use them in a solution-oriented manner. They know how conventional and PC-based controls work and can program these controls with different programming languages. They know the basics of bus systems and can name different bus systems and their areas of application. They can formally describe controls as discrete systems by means of automata, Petri nets and UML state diagrams and use these models for the methodical design of logic controllers, sequence controllers, control systems and diagnostic units.

3 Contents:

Introduction to control technology

- Terms
- Definitions

Sensors and actuators

- Standard sensors and their application (inductive, optical)
- Basics of FI and servo technology, pneumatics
- Safety functions (ST0; SS1; SS2; SOS...)

Bus technology

- Basics of industrial communication
- Comparison of different bus systems and their areas of application

Design and structures of industrial controls

- PLC and PC-based control
- Information processing

Structured programming according to IEC 61131

- Graphics- and text-based programming languages
- Basics of object-oriented PLC programming

Linkage controls

- Description of discrete systems by deterministic automata
- Model-based control design
- Practical implementation in ST and UML state diagram

	Sequence controls and schedule controls • Description of discrete systems • Model-based design and practical implementation of the control system Error management • Fault diagnosis and detection • Preventive diagnosis
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals
5	Participation requirements: Formal: Content:
6	Forms of assessment: Written exam, project work or oral exam
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Thomas Freund
11	Other information:
12	Language: German

Innovation and Project Management					IPM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3211	150 h	5	3rd/4th/5th/7th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students:

- are prepared to lead product development and innovation projects and teams to success in terms of holistic and strategically oriented project management (also including agile methods).
- understand the basics of project management and can use the elementary technical vocabulary.
- can explain the most important instruments of project management.
- are able to lead/manage a project in a given process-organisational project organisation.
- are able to develop and specifically use control options for different project phases (controlling of the degree of completion, cost controlling).
- can explain the specifics of team building and project management.
- can carry out the moderation of team meetings projects.
- know instruments of IT-supported project management.
- can explain the importance of corporate objectives and are able to distinguish between different management cultures.
- can name essential aspects of industrial property protection.

3 Contents:

- Basics of project management (terms/methods/instruments)
- Project phase models and planning systems (project preparation, project planning, project implementation, project completion)
- Agile project management
- Forms of project organisation
- Innovation and change management, self-management
- Project planning (project structure plan/cost plan/resource plan/schedule)
- Project documentation/project controlling
- Risk management
- Special features of the use of methods in innovation projects

	(Strategic preparation / initiation, planning, monitoring and control of innovation projects) • Leading project and innovation teams (social structures, special communication situations in projects, real and virtual project work, problem analysis and concepts for action) • Stakeholder management (factors influencing the successful management of projects) • Methods of idea generation (creativity techniques etc.) • Trainings and workshops on selected technical examples • Basic aspects of industrial property protection
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Term paper, written examination, project work or oral examination
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Michael Fahrig
11	Other information: -
12	Language: German

Colloquium					KOL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3134	90 h	3	7th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	90	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: In the colloquium, students demonstrate that they are able to present the results of the bachelor thesis, its subject-specific foundations, its interdisciplinary connections and its extra-subject references orally and justify them independently. Students can critically question the results of their work and are able to assess their significance for practice.
3	Contents: The colloquium complements the bachelor thesis and is to be assessed independently. Content of the thesis according to the topic Disputation on the procedure in the preparation of the thesis and the issues that arose in the context of the thesis.
4	Forms of teaching: Oral examination
5	Participation requirements: Formal: All modules of the study programme must be successfully completed. The bachelor thesis must be successfully completed. Content: Treatment of the bachelor thesis
6	Forms of assessment: Oral examination
7	Prerequisite for the award of credit points:
8	Application of the module (in the following study programmes) Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: N. N.
11	Other information: -
12	Language: German

Power Electronics					LE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3123	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

The module provides knowledge of the most important power semiconductors and the power converter circuits that can be realised with them. Students should be able to explain the physical functioning of semiconductors and, in particular, to describe the basic circuits of semiconductor converters for converting, controlling and switching electrical energy.

3 Contents:

General
Switching of ohmic-inductive loads
Introduction to power semiconductors

Thermal conductivity model

Switching behaviour of power semiconductors

Converter circuits
Single-pulse rectifier
Multi-pulse rectifier
Boost/buck converter
H-Bridge inverter
Three-phase inverters

Harmonics and power

Application circuits in automation
Switching power supplies
Electronic switches
Electronic actuators
Electromagnetic compatibility (EMC)

4 Forms of teaching:

Learning materials for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	None
Content:	None

6	Forms of assessment: Term paper, written examination, project work or oral examination
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Michael Leuer
11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Mathematics I					MATH1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3218	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2	Learning outcomes/competences: The students are familiar with the mathematical working method and have mastered the basic terms and methods from the areas of analysis and linear algebra, which they can also apply to practice-oriented problems from technology, natural science and economics.
3	Contents: • General basics (set theory, inequalities, propositional logic, methods of proof) • Functions of one variable (limit and continuity, polynomial functions, rational functions, trigonometric functions, exponential function, logarithm function) • Differential calculus for functions of one variable (differentiability, derivation rules, applications) • Linear algebra (vectors, matrices, determinants, systems of linear equations, eigenvalues and eigenvectors)
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written examination, combined examination, oral examination or examination during the course
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics /Automation (work-integrated) B.Eng., Product Service Engineering work-integrated B.Eng. and Industrial Engineering (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Dr. rer. nat. Sabrina Proß
11	Other information: -

12	Language: German

Mathematics II					MATH2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3257	150 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students:

- can deepen their knowledge in the area of calculus.
- master the essential principles of integral calculus and differential calculus for functions of several variables.
- have an overview of the methods for the analytical solution of ordinary differential equations and systems of differential equations and can apply these to practice-oriented problems.

3 Contents:

- Complex numbers (definition and representation, complex calculus)
- Integral calculus for functions of one variable (fundamental theorem of differential and integral calculus, integration rules, integration methods, improper integrals, applications)
- Differential calculus for functions of several variables (functions of several variables, partial differentiation)
- Ordinary differential equations (differential equations of the 1st order, linear differential equations of the 2nd or nth order with constant coefficients, systems of linear differential equations)

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	- Modules: 3218 Mathematics I

6 Forms of assessment:

Written examination, combined examination, oral examination or examination during the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10	Module coordinator: Dr. rer. nat. Sabrina Proß
11	Other information: -
12	Language: German

Mathematics III					MATH3
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3258	150 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students:

- know the most important numerical algorithms and their possible applications and are able to handle numerical problems and estimate errors of numerical calculations.
- can implement simple algorithms in a higher programming language on a computer.
- can develop functions in power and Fourier series.
- are familiar with the basics and properties of the Fourier and Laplace transform.

3 Contents:

- Numerics (numerical determination of zeros, numerical differentiation, numerical integration, numerical solution of differential equations)
- Power series development (infinite series, power series, Taylor series)
- Fourier series
- Fourier transform
- Laplace transform
- Use of Matlab/C++/Python

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	- Modules: 3218 Mathematics I; 3257 Mathematics II

6 Forms of assessment:

Written examination, combination examination, project work, oral examination or examination during the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Mechatronics/Automation (work-integrated) B.Eng. and Product-Service Engineering (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10	Module coordinator: Dr. rer. nat. Sabrina Proß
11	Other information: -
12	Language: German

Mechatronic Systems					MES
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3131	150 h	5	7th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	1	SCH	0	h	32	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	3	SCH	24	h	70	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

Students learn about different types of mechatronic systems such as household appliances, combine harvesters, machine aggregates, packaging machines, woodworking plants and machine tools and their special features.
Students are able to consistently and systematically develop complex mechatronic and automated systems themselves and to subject them to an orderly development process.
They are able to use the knowledge acquired during their studies to develop mechatronic and automated systems.

3 Contents:

- Structure and function of mechatronic and automated systems and their special features
- Design guidelines for mechatronic and automated systems
- Modularisation of machine types and units
- Control types
- Control architecture
- Development of a mechatronic and automated system
- Planning/conception
- Concretisation/modelling/simulation
- Realisation/commissioning using appropriate design methods
- Documentation and presentation
- Basic system properties

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Term paper, written examination, project work or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Mechatronics/Automation (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10	Module coordinator: Prof. Dr.-Ing. Thomas Freund
11	Other information: -
12	Language: German

Measuring Systems and Sensors					MUS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3128	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2	Learning outcomes/competences: This module covers the basics of important sensor principles, analogue sensor electronics (signal pre-processing) and the most common sensor types. The students learn about known sensor technology in the industrial environment and should master its application.
3	Contents: • Basics of measurement signal processing • Sensors and measuring systems in industrial application • Components of measuring signal acquisition and processing systems • Temperature measurement • Pressure measurement • Flow measurement • Level measurement • Measurement of substance properties • Measurement of geometric quantities (especially position detection) • Optical inspection systems • Power and energy measurement
4	Forms of teaching: Learning materials for self-study, classroom sessions in the form of exercises and practicals.
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Term paper, written examination, project work or oral examination
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Thomas Freund
11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Methodical Design and CAD					MKC
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3354	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

Students are able to plan and structure design projects. They distinguish between the different design phases and apply selected methods and tools in a goal-oriented manner. They establish measurable requirements, derive functions, generate partial solutions, create overall solutions, estimate the cost effects of design work, evaluate, select and optimise.

With regard to CAD, students are able to:

- Describe the functions and possibilities of common 3D CAD systems
- Classify CAD with regard to product lifecycle management
- Create and manipulate simple 3D models
- Derive 2D drawings from 3D models

3 Contents:

Methodical construction:

- Introduction to methodical procedures and the sequence of the design process
- VDI guidelines for methodical development
- Task clarification, requirements management, requirements lists
- Creativity techniques via functions to operating mechanisms and construction elements
- Series and construction kits
- Technical-economic design (according to VDI 2225)
- Value analysis

CAD systems and techniques:
Definition of terms, equipment technology, software systems, data exchange, input techniques, coordinate systems, construction methods for geometric models (corner, edge, surface, solid models), methods for structuring CAD data, variant construction by parametrisation, solid modelling

Practical training on a CAD system

4 Forms of teaching:

Learning materials for self-study, classroom events in the form of exercises and practicals.

5 Participation requirements:

	Formal:	
	Content:	Modules: 3253 Basics of Mechanical Design
6	Forms of assessment: Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points: Module examination pass and course assessment	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Klaus Dürkopp	
11	Other information: Supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Microcontroller Programming					MCP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3220	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

Students:

- learn the basics of embedded systems based on microcontrollers and single-board computers.
- get hands-on experience in designing hardware-based microcontroller product architectures and cloud solutions, low-power M2M communication as well as sensor networks.
- are capable of implementing their own small hardware projects.
- can evaluate and make judgements about systems or products based on embedded systems.
- can translate customer requirements into viable technical concepts and product architectures, taking into account efficiency and modularity.

3 Contents:

- Basics
- Embedded Systems
- 'Internet of Things' (IoT)
- Network technologies (Ethernet, Wifi, Bluetooth, etc.). Identification technology (barcode scanners, RFID systems)
- Concepts and aids (tools) of embedded systems and IoT
- Embedded systems platforms (e.g. Ardunio/Energia, Raspberry PI, ARM microcontrollers, etc.)
- Communication via bus systems (e.g. I2C, SPI, UART)
- Reading out sensors
- Special components (A/D converter, D/A converter)
- Integration into overall systems

4 Forms of teaching:

Learning materials for self-study, classroom sessions in the form of exercises and practicals.

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Term paper, written examination, project work or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

8	Application of the module (in the following study programmes) Digital Logistics (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker
11	Other information: -
12	Language: German

Object-Oriented Programming and Databases					OPDB
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3268	150 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	54	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successful completion of the module, the students have an understanding of object-oriented programming and its distinctions and differences from structured programming. They can analyse concrete problems from IT and design and implement suitable solutions in the programming language C++. The students have an overview of selected design patterns and can evaluate and implement their application in given problems. The students have gained knowledge of selected models of UML and can apply them.
In the area of databases, the students know the basics and possible applications of databases after successful completion of the module. They are able to create simple logical and physical data bank models and create databases. They are able to apply the database language SQL.

3 Contents:

Introduction to object-oriented programming:

- Basic concepts
- Differences between procedural and object-oriented programming

Programming in C++:

- Create and use classes
- Objects and methods
- Inheritance and multiple inheritance
- Templates
- Error handling

Software development:

- Design pattern
- Waterfall model, V model
- UML class diagram

Databases:

- Introduction, elementary terms on databases and related technologies
- Data modelling
- Normal forms
- Database language SQL

4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises.	
5	Participation requirements:	
	Formal:	
	Content:	
6	Forms of assessment: Written exam, project work or oral exam	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker	
11	Other information:	
12	Language: German	

Personnel and Organisation					PUO
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3011	150 h	5	7th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

The students have a basic overview of the tasks of human resource management. They know the essential methods of personnel recruitment, personnel development and personnel evaluation and can evaluate them with regard to their suitability and applicability.
They are familiar with essential theoretical concepts on communication, understand the problems that can occur during the communication process and have practised possible solutions.
They understand the importance of learning for change processes and can shape the conditions for successful learning.
They can explain the principles of organisational theory and have checked their significance using practical examples. They can use primary and secondary organisational forms with regard to their applicability.
They are familiar with important topics of organisational change and can assess their significance for entrepreneurial activity.
They have a basic knowledge of the characteristics and significance of key qualifications and have demonstrated this with the help of examples, e.g. in conflict resolution and motivational skills.

3 Contents:

- Significance, goals and tasks of human resources management
- Fundamentals of labour law
- Fundamentals of Communication
- Fundamentals of Learning Theory
- Environmental conditions, learning control, lifelong learning strategies
- Organisational and operational structure, forms of primary and secondary organisation
- Organisational change
- Personnel management and conflict resolution

4 Forms of teaching:

Learning materials for self-study, classroom events in the form of exercises

5 Participation requirements:

Formal: None

	Content:	None
6	Forms of assessment: Term paper, written examination, performance examination, project work or oral examination	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Digital Logistics (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Economist Ulrike Franke	
11	Other information:	
12	Language: German	

Physics					PH
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3101	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2	Learning outcomes/competences:	
	The students know the importance of physics as the basis of engineering work. They are able to analyse physical processes and relate them to basic physical laws. The students have the ability to use formulas, devices and measurement results in solving physics problems. Furthermore, they possess the competence for the scientific implementation, evaluation and documentation of experiments for the verification of theoretical facts, a competence that is required e.g. within the framework of research and development projects. The knowledge acquired forms the basis for a variety of advanced courses, as physics is the basis for a variety of technologies.	
3	Contents:	
	Mechanics Kinematics: one and three-dimensional translation, rotation, relation, relative movements Dynamics: Newton's axioms, types of forces, work-energy-power, momentum, rotation, angular momentum Optics Light and photons, refraction and dispersion, geometrical optics, optical instruments, lasers Thermodynamics Temperature, thermal expansion, behaviour of gases – Gas laws, kinetic theory of gases, heat, first and second law of thermodynamics	
4	Forms of teaching:	
	Learning materials for self-study, classroom events in the form of exercises and practicals.	
5	Participation requirements:	
	Formal:	None
	Content:	None
6	Forms of assessment:	
	Term paper, written examination, performance exam or oral exam	
7	Prerequisite for the award of credit points:	
	Module examination pass and course assessment	
8	Application of the module (in the following study programmes)	
	Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	

9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: N. N.
11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Practical Module I					PX1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3112	150 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	150	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h
2	Learning outcomes/competences: Students acquire and deepen knowledge and skills specific to the study programme. For this purpose, individual problems are worked on holistically and under practical conditions during the work term at the company and solution options are developed independently. In addition to the professional competence, the students acquire the ability of working scientifically and successively develop it further.							
3	Contents: The topics to be worked on must be related to engineering science and be oriented towards the module contents of the curriculum. The topic is coordinated between the student, the faculty tutor in the company and the examiner at the University of Applied Sciences.							
4	Forms of teaching: Work-related module							
5	Participation requirements:							
	Formal:	-						
	Content:	-						
6	Forms of assessment: Term paper							
7	Prerequisite for the award of credit points: Module examination pass							
8	Application of the module (in the following study programmes) Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.							
9	Importance of the grade for the final grade: according to BRPO							
10	Module coordinator: Prof. Dr.-Ing. Andrea Kaimann							
11	Other information: -							
12	Language: German							

Practical Module II					PX2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3122	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	150	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students acquire and deepen knowledge and skills specific to the study programme. For this purpose, individual problems are worked on holistically and under practical conditions during the work term at the company and solution options are developed independently. In addition to the professional competence, the students acquire the ability of working scientifically and successively develop it further.	
3	Contents:	
	The topics to be worked on must be related to engineering science and be oriented towards the module contents of the curriculum. The topic is coordinated between the student, the faculty tutor in the company and the examiner at the University of Applied Sciences.	
4	Forms of teaching:	
	Work-related module	
5	Participation requirements:	
	Formal:	Module examination pass in Practical Module I
	Content:	-
6	Forms of assessment:	
	Term paper	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr.-Ing. Andrea Kaimann	
11	Other information:	
	-	
12	Language:	
	German	

Practical Module III					PX3
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3129	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	150	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students acquire and deepen knowledge and skills specific to the study programme. For this purpose, individual problems are worked on holistically and under practical conditions during the work term at the company and solution options are developed independently. In addition to the professional competence, the students acquire the ability of working scientifically and successively develop it further.	
3	Contents:	
	The topics to be worked on must be related to engineering science and be oriented towards the module contents of the curriculum. The topic is coordinated between the student, the faculty tutor in the company and the examiner at the University of Applied Sciences.	
4	Forms of teaching:	
	Work-related module	
5	Participation requirements:	
	Formal:	Module examination pass in Practical Module II
	Content:	-
6	Forms of assessment:	
	Term paper	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr.-Ing. Andrea Kaimann	
11	Other information:	
	-	
12	Language:	
	German	

Feedback Control Engineering					RTK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3125	150	5	4. Semester, 5. Semester or 6th semester	every semester	1 semester

1	Course:	Planned group sizes	Scope		actual Contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, the students will be able to assign the basic correlations from the field of control technology. The students are able to recognise the benefits of control systems in a problem-oriented manner and develop solution strategies. In addition, the students can solve simple control engineering tasks, i.e. find the corresponding controllers and their parameterisation for simple technical processes. Students can resolve and simplify more complicated control engineering structures. In addition, the students can predict the behaviour of the closed control loop on the basis of a mathematical circuit model. In small groups, the students have gained initial experience with the design and implementation of simple controls for simple processes and have implemented and tested them using common simulation software such as MATLAB Simulink.

3 Contents:

Introduction to Control Engineering

- Terms
- Definitions
- Block diagrams

Transmission link analysis

- Steady-state and dynamic behaviour
- Frequency response and floor diagram
- Determining mathematical models for technical systems
- The control loop
- Basic structure of the control loop
- Control loop structures
- Stability behaviour of control loops
- Classical linear controllers
- Simple design procedures
- Parameter-optimal controls

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	
Content:	

6	Forms of assessment: Term paper, written examination, project work or oral examination
7	Prerequisite for the award of credit points: module examination pass and course assessment
8	Application of the module (in the following study programmes) Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Michael Leuer
11	Other information: -
12	Language: German

Statistics					STAT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3224	150 h	5	3rd or 4th semester	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students:

- can explain basic concepts of statistics.
- can apply the basic methods and procedures of descriptive statistics and probability theory.
- are able to analyse economic questions and problems with statistical methods and to show correlations.
- are able to solve tasks with the help of suitable software (SPSS, Excel,...).

3 Contents:

- Descriptive statistics (one-dimensional frequency distributions, measures, multivariate statistics, regression analysis)
- Probability theory (discrete and continuous distributions)
- Statistical interference
- Use of Excel/SPSS

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering
(work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Dr. rer. nat. Sabrina Proß

11 Other information:

-

12	Language: German

Engineering Mechanics – Kinematics and Kinetics					TMB
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3111	150 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

The students have basic knowledge of the movement processes of bodies, vehicle and machine parts. They can analyse all kinds of movement processes:

- They can gain an overview of the movement processes taking place in machines and machine components, for example.
- They are able to analyse the speeds and accelerations occurring during movements.
- They can calculate trajectories of mass points and individual body points of a machine.
- They can calculate the work done and the power or energy stored or released.
- They can analyse impact processes.
- They are able to analyse simple vibration processes in technology.

3 Contents:

Kinematics and kinetics, introduction to the topic delimitation kinematics:

- Kinematics of the point
- Kinematics of the disc

Kinetics:

- Kinetics of the point of mass
- Pure translational motion; work, energy, power momentum, law of momentum, law of conservation of momentum for mass points
- Motion of a body in a medium
- Rotation of a body around a fixed axis; work, energy power in rotary motion; momentum, momentum theorem
- Momentum conservation law for rotary motion; general, plane motion of a rigid body

4 Forms of teaching:

Teaching materials for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	Successful participation in the internship.
Content:	Knowledge of the contents of the module "Engineering Mechanics – Statics and Strength of Materials" (3108)

6	Forms of assessment: Written examination, combination examination, project work or oral examination
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Andrea Kaimann
11	Other information: • Supplementary literature will be announced at the beginning of the course. • It is recommended to have previously taken the module "Engineering Mechanics – Statics and Strength of Materials".
12	Language: German

Engineering Mechanics – Statics and Strength of Materials					TMA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3108	150 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

The students know and understand the basic relationships of statics as the study of the balance of forces in and on mechanical structures at rest and can apply these independently to simple examples from practice.
Furthermore, they know the basic relationships between the external loads and the resulting internal stresses and deformations, so that they can carry out strength verifications for simple statically stressed components using relevant material parameters.

3 Contents:

Basic concepts of mechanics:

- Force – balance – rigid body
- Statics: Introduction – Plane system of forces – Centre of gravity – Static balance of bodies – Freeing – Determination of bearing and intermediate reactions – Friction
- Strength of materials: Introduction to strength theory – Internal forces – Tensile or pressure load – Shear – Bending load – Torsional stress – Buckling Stress – Composite stress

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	None
Content:	None

6 Forms of assessment:

Written examination, combination examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

8 Application of the module (in the following study programmes)

Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Andrea Kaimann

11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Technical English					TCE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3121	150 h	5	1st, 3rd or 5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	2	SCH	32	h	46	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

- Expertise: Students demonstrate that they have extended their active general language competence from B1.2 and achieved a B2.1 level. They possess a sound basic vocabulary of Technical English and master the contextually relevant grammar. They communicate spontaneously and fluently in engineering job situations. They formulate issues confidently, clearly and in detail in English both in speaking and writing
- Social competence: They try out and consolidate communicative key skills in English presentations, teamwork and project work.
- Methodological competence: They use targeted strategies for content acquisition and critical analysis of technical texts and for solving contextual tasks. They can present technical issues in a way that is appropriate for the target group.
- Personal competence: They assume responsibility for their learning process; they research and structure authentic material, organise workloads and meet deadlines.

3 Contents:

- Students master the core terminology of the technical and organisational content of their study programme (e.g. dimensions and shapes; numbers, symbols and mathematical operations; materials and manufacturing; automated systems and Industry 4.0; logistics; international trade, etc.).
- They possess skills (e.g. emailing; writing reports and abstracts; project pitches; discussing readings and trends; designing conference posters).

4 Forms of teaching:

Seminar-based teaching / individual and group work, etc.
Project task (Assignment)

5 Participation requirements:

Formal:	
Content:	English language competence: B1.2 (according to the European Reference Framework of Languages)

6	Forms of assessment: Combination examination
7	Prerequisite for the award of credit points: 70% attendance and active participation, passed semester project and written exam
8	Application of the module (in the following study programmes) Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: OStR Cornelia Biegler-König
11	Other information: -
12	Language: English

Elective Module Mechatronics/Automation					WM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
9010	150 h	5	5th or 6th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students		SCH		h		h
	Tuition in seminars	30 students		SCH		h		h
	Exercise	20 students		SCH		h		h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students		SCH		h		h
2	Learning outcomes/competences:							
3	Contents:							
4	Forms of teaching:							
5	Participation requirements:							
	Formal:							
	Content:							
6	Forms of assessment:							
7	Prerequisite for the award of credit points:							
8	Application of the module (in the following study programmes) Mechatronics/Automation (work-integrated) B.Eng.							
9	Importance of the grade for the final grade:							
10	Module coordinator:							
11	Other information:							
12	Language: German							