Appendix B: Module catalogue

for the study programme Mechatronics B.Sc.

Bachelor Thesis					BA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1291	360 h	12	6th or 7th sem.	each semester	12 weeks

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	360	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: With the bachelor thesis, each candidate demonstrates that he/she is able to complete a practice-oriented task from his/her subject area within a specified period of time, both in its subject-specific details and in the interdisciplinary contexts, working independently and according to scientific methods.
3	Contents: The bachelor thesis is usually an independent investigation with an engineering science or engineering technology task. It should deal with the subject matter in detailed descriptions and explanations It should deal with the subject matter in detailed descriptions and explanations and be prepared as a written paper.
4	Forms of teaching:
5	Participation requirements: Formal: None 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) Biotechnology and Instrumentation Engineering (B.Sc.), Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.), Mechanical Engineering (B.Eng.), Mechatronics (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: N.N.
11	Other information:
12	Language: German

Career-Focused Project					BOP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1019	150 h	5	1st sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	0	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	2	weekly hours	30	h	120	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students acquire an overview of the professional field of engineering against the background of the specialist field of mechatronics. They know the basics of engineering and scientific work in projects and apply methods and tools for the development of a mechatronic solution in a guided group organisation. The results of the work of the individual participants are discussed, distributed and criticised within the team. The students identify the next steps of a project process and draw conclusions and inferences for the conclusion and the outlook. They are able to present technical facts and document them.

3 Contents:

- Overview of the fields of activity and the everyday work of a mechatronics engineer
- Classification of mechatronics in relation to other engineering disciplines
- Overview of tasks in the professional field of mechatronics
- Fundamentals of engineering work
- Basics of scientific work
- Task description and structuring of tasks
- Project management techniques, presentation techniques, technical communication and documentation, research and source work
- Sequence of a problem-solving process on a simple technical example from everyday engineering practice or training

4 Forms of teaching:

Seminar project

5 Participation requirements:

Formal:	None
Content:	None

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

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

Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Klaus Dürkopp

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

Business Administration					BWL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1027	150 h	5	2nd or 4th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	3	weekly hours	45	h	67.5	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students know the basic organisational and legal structures of companies and are familiar with the optimisation tasks in selected entrepreneurial functional areas as well as with the basic principles and success criteria of economic action in order to be able to classify their engineering activities in a business management context and to evaluate the economic consequences of their activities. The students master methods and tools for problem solving in selected corporate functional areas. They can apply business management instruments and calculation methods in a target-oriented manner and assess their effects.

3 Contents:

- Classification, development and basic concepts of business administration
- Basic concepts of business administration / basic principles of economic action
- Overview of the entrepreneurial functional areas of the goods economy, financial and information level
- Corporate goals and corporate key figures / key figure systems
- Basic concepts of private and commercial law
- Corporate legal forms

4 Forms of teaching:

Lecture, sem. lessons with case studies and examples

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

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

Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. rer. oec. Klaus Rüdiger

11 Other information:

Literature will be announced at the beginning of the course.

12 Language:

German

Machine Vision					BIL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1029	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Name and explain the basic concepts, elementary connections and laws of machine vision. Demonstrate and apply the basic descriptive tools and analytical methods of machine vision. Name the current areas of application. Understand and interpret the practical significance of machine vision. Capable of developing independent solutions in simple application areas of machine vision.
3	Contents: Historical overview and current developments in machine vision, sensor systems for image data acquisition, basics of technical optics for the acquisition of scenes, illumination and object positioning, programming systems, handling machine vision programmes, LUT and grey value programming, contour analysis and edge detection, filters in the spatial and frequency range, morphology, template matching, colour image processing, applications of machine vision as a quality assurance tool, biotechnological and medical applications, design of machine vision systems, machine vision software, design of vision systems for process monitoring.
4	Forms of teaching: Lecture, practicals and exercises
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written examination, combination examination, performance 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) Biotechnology and Instrumentation Engineering (B.Sc.), Electrical Engineering (B.Eng.), Mechatronics (B.Sc.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Reinhard Kaschuba
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Database Applications					DBA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1041	150 h	5	6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

- The students have basic knowledge of the advantages and possibilities of the structure and use of relational databases, and can explain and apply this knowledge. On the basis of this knowledge, they are able to independently design real-world objects as a hierarchical database model and to map them practically in an SQL database.
- Students insert new data into a relational database, perform complex queries of data according to given criteria and join tables according to chosen integrity rules.
- The students apply techniques of web server programming (e.g. JakartaEE) and plan applications in group work according to the Model-View-Controller-Software-Pattern to modify data of a database and to insert and query it via a web interface (Javascript Framework).
- Students will be able to compare, combine and evaluate specific methods and techniques for databaseapplications and will be able to plan and develop database transactions.
- The students will learn about the advantages of object-based, distributed database applications and be able to classify them.

3 Contents:

- Knowledge of the architecture, functioning and use of database systems,
- Basic concepts of relational and object-relational data models,
- Introduction to SQL (Structured Query Language),
- Use of SQL to create, delete, modify and query data records,
- Introduction to programming dynamic web pages (e.g. JakartaEE, JSF, Primefaces),
- Connection of databases in web applications using suitable examples.

4 Forms of teaching:

Lecture, sem. lessons, project and group work within the framework of the practical

5 Participation requirements:

Formal:	None
Content:	Good knowledge in the field of object-oriented programming, general algorithms and data structures (generic programming) Modules: 1001 Algorithms and Data Structures; 1105 Computer Science 1; 1109 Computer Science 2; 1245 Software Engineering

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) Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Lutz Grünwoldt
11	Other information: Literature will be announced at the beginning of the course. A script will be provided.
12	Language: German

Introduction to the Railway System									ESB
Identification number:		Workload:		Credits:		Study semester:		Frequency of the offer:	Duration:
7003		150		5		1st semester		Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students		weekly hours		h		h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students		weekly hours		h		h

2	Learning outcomes/competences:	
	Students will gain basic knowledge of the requirements for railway systems and their different characteristics. They will have an overview of how the various technical components interact and what dependencies exist.	
3	Contents:	
	The lecture will provide an overview of the various railway systems (trams, underground trains, suburban trains, passenger and freight transport) and their specific characteristics. There will be an introduction to the most important subsystems and components such as track guidance, power supply, drive and braking technology, infrastructure as well as control and safety technology. The relationships and dependencies of the individual subsystems will be communicated. In addition, aspects of railway operation, logistics and maintenance will be covered. An overview of the roles of the various stakeholders involved in the railway system (companies, authorities, etc.) will be provided.	
4	Forms of teaching:	
5	Participation requirements:	
	Formal:	
	Content:	Basic knowledge of mathematics, mechanics and materials science
6	Form of assessment:	
	Oral examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes):	
	Digital Railway Systems	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	- N.N.	
11	Other information:	
12	Language:	
	German	

Electric Drive Systems					EAS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1313	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

With reference to the contents listed below, the students use the components of variable-speed electrical drives in a targeted manner. As prospective mechatronics engineers, they can suitably assemble and design a drive system for a specific application. They can use the space vector representation for modelling the rotating field machines and dimension them for the control based on it. They will be enabled to commission typical industrial drive systems and adapt them to the respective applications.

3 Contents:

- Components and basic circuits of the relevant power electronics
- Interactions of the frequency inverters with the mains and motor
- Torque formation in rotating electrical machines
- Design and operating behaviour of DC machines
- Modelling and control of the drive system with DC machines
- Space vector for the description of rotating field machines
- Design and operating behaviour of synchronous machines
- Modelling and control of the drive system with PSM
- Structure and modelling of the asynchronous machine
- Operating behaviour of the ASM on the rigid network
- Behaviour of the ASM during operation with frequency converter
- Overview of further electrical actuators, e.g. piezo drives or magnet bearings

4 Forms of teaching:

Lecture, sem. lessons with exercises and practical course

5 Participation requirements:

Formal:	
Content:	Electrical Engineering I (1073 Mechatronics, 1070 Engineering Computer Sciences, 1070 Industrial Engineering and Management), Electrical Engineering II (1076 Mechatronics), Electronics (1063 Mechatronics. 1067 and 1069 Engineering Computer Sciences, 1065 Industrial Engineering and Management)

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 (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO or SPO if ungraded elective subject
10	Module coordinator: Prof. Dr.-Ing. Andreas Bünte
11	Other information:
12	Language: German

Electromobility / Vehicle Dynamics					FDE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1308	150 h	5	5th or 7th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students have a sound knowledge of the power and energy requirements of motor vehicles depending on the respective usage profile and the real cycle. They are familiar with the various theoretical driving cycles and have mastered simulation tools for evaluating the energy demand for both theoretical and real driving cycles of motor vehicles.
The students are familiar with the various drive configurations and components of electrically powered vehicles and the different drive concepts of hybrid vehicles and are particularly familiar with the differences in energy conversion systems between conventional and electric drive train systems. They will be able to simulate driving cycles of electric vehicles on the basis of characteristic diagrams of the energy storage and energy converters on the basis of sound knowledge of longitudinal vehicle dynamics. The students are able to evaluate the possibilities and limits of electric mobility with regard to the respective application profile of the individual vehicle and know the requirements for the electrical energy supply when using electric vehicles.

3 Contents:

- Longitudinal vehicle dynamics: Power and energy demand
- Vehicle powertrain of conventional drive systems
- Vehicle powertrain of alternative drive systems
- Energy converter in the vehicle powertrain
- Hybrid drive systems
- Driving cycles: Theoretical driving cycles / real driving cycles
- Recording and evaluation of real driving cycles
- Energy balancing using the example of a self-driven driving cycle
- Mobile energy storage systems in comparison
- Electrical energy storage
- Charging and discharging characteristics
- Demand-oriented design of electric vehicles
- Primary energy supply / energy flows
- Possible contribution of networked energy storage systems for e-mobiles to the balancing of peak loads in electricity grids

4 Forms of teaching:

Lecture, sem. lessons

5 Participation requirements:

	Formal:	
	Content:	General basic knowledge in the subject mechanics / dynamics is assumed
6	Forms of assessment: Written examination, combination examination, performance 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 (B.Sc.)	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Herbert Funke	
11	Other information:	
12	Language: German	

Electronics					EL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1063	150 h	5	2nd sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

In relation to the contents listed below, the students use the elementary methods of electronics in a targeted manner and interpret the correlations. They use the most important components and basic circuits used in electronics. They can analyse, design and evaluate basic electronic circuits.

As future mechatronics engineers and biotechnologists, they identify the importance of electronics in these fields. Furthermore, they can classify essential aspects of the development and production of electronic systems and assemblies.

3 Contents:

- Passive components
- Fundamentals of semiconductor physics
- Semiconductor components, in particular diodes and transistors and their basic circuits
- Operational amplifiers and their applications
- Basics of digital and analogue circuits
- Integrated Circuits/Microelectronics
- Electronics development and manufacturing

4 Forms of teaching:

Lecture, sem. lessons with exercises, practical course

5 Participation requirements:

Formal:	None
Content:	Electrical Engineering1 (1073)

6 Forms of assessment:

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)

Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Andreas Bünte

11 Other information:

Literature will be announced at the beginning of the course.

12 Language:

German

Electrical Engineering 1					ET1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1073	150 h	5	1st sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

In relation to the contents listed below, the students use and apply the elementary electrotechnical correlations and laws in technical systems. They can analyse, design and evaluate DC networks. They can examine given setups and dimension simple circuits appropriately. The students will be able to identify, design and assess basic electrotechnical boundary conditions for applications typical of the course of study.

3 Contents:

- Basic knowledge
- Charge, current and voltage, electric field, Coulomb force, capacitances
- Resistance and resistance behaviour, Ohm's law
- Energy and power
- DC circuits, counting arrow systems, Kirchhoff theorems, ideal and real sources,
- Series, parallel and bridge circuit, voltage and current divider
- Network calculation
- Magnetic field, law of induction, inductance, force effect in the magnetic field, Lorentz force
- Static and dynamic processes, sinusoidal excitation, impedance

4 Forms of teaching:

Lectures, exercises, practicals

5 Participation requirements:

Formal:	None
Content:	None

6 Forms of assessment:

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)

Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Andreas Bünte

11	Other information: Literature will be announced at the beginning of the course. see ILIAS
12	Language: German

Electrical Engineering 2					ET2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1076	150 h	5	3rd or 5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

In relation to the contents listed below, the students can identify and present the extended electrotechnical correlations and laws in the area of alternating current; they can confidently apply the associated terms and methods for describing dynamic processes in electrotechnical systems. Students analyse, describe and calculate AC networks. By gaining an insight into current areas of application, they can classify and evaluate the practical and economic significance. Students will be able to identify, design and apply advanced electrotechnical boundary conditions for applications typical of the course of study.

3 Contents:

Basic feature:
Basic electrical engineering terms
System term, linearity
Dynamic systems, classification: static, transient, stationary
Complex quantities
Periodic signals, sinusoidal signals, exponential oscillation
Impedance, admittance
Reactive power, apparent power, active power
Three-phase current
Frequency response, Nyquist plot
RLC circuits, resonant circuits, resonance behaviour
Transfer function, frequency response, amplitude and phase response
Passive filters
Fourier analysis

4 Forms of teaching:

Lecture, sem. lessons with exercises, practical course

5 Participation requirements:

Formal:	None
Content:	Electrical Engineering (1070 or 1073), Electronics (1063 or 1065)

6 Forms of assessment:

Written examination, combination examination, performance 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 (B.Sc.) and Industrial Engineering and Management (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Joachim Waßmuth
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Embedded Systems					ESYS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1079	150 h	5	6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students:

- name and explain the different hardware concepts on which common embedded systems are based.
- explain the underlying hardware technologies, name advantages and disadvantages and evaluate the applicability for various practical problems.
- implement combinatorial and sequential function blocks in a synthesis language (e.g. VHDL) and use common toolchains to bring the synthesised functions to a target hardware (e.g. FPGA).
- develop a complex logic component according to specifications based on the previously developed function modules.
- evaluate algorithms with regard to their implementability in hardware or software (hardware/software co-design).
- explain design concepts for the hardware-related processing of discrete and continuous signals.
- distinguish the parallel design of algorithms for the hardware synthesis from conventional programming.
- compare their synthesis results with those of the other students and discuss differences in small groups.

3 Contents:

- Introduction to the topic of embedded systems (reactive, transforming systems, etc.)
- Classification of embedded hardware (microcontrollers, microprocessors, FPGAs, SoCs, etc.)
- Hardware technologies for the implementation of digital logic (SPLDs, CPLDs, FPGAs, ASICs)
- Repetition of combinatorial and sequential logic (pipelining etc.)
- Concepts of reliability, efficiency, hard and soft real time
- Hardware description languages (synthesis languages such as VHDL, VERILOG) compared to programming languages
- Introduction to VHDL
- Implementation of combinatorial and sequential logic components such as adders, multiplexers, automata, etc. in VHDL and their synthesis for an FPGA
- Synchronisation of the communication of asynchronous systems (one-synchronisation, metastability)
- Implementation of simple bus systems

	- Aspects of hardware/software co-design - Control of mechatronic systems such as robots	
4	Forms of teaching: Lecture, sem. lessons, practical course	
5	Participation requirements:	
	Formal:	None
	Content:	Basic knowledge in the fields of digital technology, programming and computer architectures Modules: 1045 Digital Electronics II; 1070 Digital Electronics I; 1104 Computer Science 1
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) Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.), Mechatronics (B.Sc.) and Industrial Engineering and Management (B.Sc.)	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. nat. Axel Schneider	
11	Other information: Literature will be announced at the beginning of the course.	
12	Language: German	

Manufacturing Processes					FER
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
1090	150	5	4th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	2	weekly hours	25	h	35	h
	Practical or seminar	15 students	1	weekly hours	5	h	10	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students have basic knowledge of the processes of production engineering. They have practical experience in the manual and machine processing of construction materials in mechanical engineering. They can carry out basic calculations for the fundamental manufacturing processes and are able to systematically select suitable manufacturing processes for specific development tasks and assess their feasibility and economic efficiency. The students are able to design mechanical engineering components for production.
They are familiar with the tools of CAD-CAM and can execute a CAD-CAM process on their own.

3 Contents:

Basics of production technology according to DIN 8580 with consideration of the material groups.
Detailed presentation of selected manufacturing processes of the process groups forming, forming, cutting and joining.

Mode of operation, design rules and basic calculations for selected manufacturing processes.
General descriptions of manufacturing processes.
CAD-CAM using the example of a 3-axis milling machine.

4 Forms of teaching:

Lecture, exercise and practical course

5 Participation requirements:

Formal:	None
Content:	None Modules: 1124 Construction;

6 Form of assessment:

Written examination or course assessment

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Industrial Engineering and Management B.Sc.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Brigitta Gänsicke

11 Other information:

Literature:
Awiszus/Bast/Dürr/Matthes: Grundlagen der Fertigungstechnik Fritz/Schulze: Fertigungstechnik
Further literature will be announced at the beginning of the course.

12	Language:
	German

Finite Element Methods					FEM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1094	150 h	5	4th or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Understand the finite element method for structural and temperature calculations, be able to build FEM models with load definition and boundary conditions, interpret results, analyse components with FEM programs in terms of deformation, stress, temperature
3	Contents: - Areas of application of the FEM - Structure of the finite element method - Geometry, nodes, elements - Shape functions, deformation approach - Element stiffness matrix, total stiffness matrix - Boundary conditions, forces - Principle of minimum potential energy - Bar, disc and solid elements - Isoparametric element formulation - Numerical integration
4	Forms of teaching: Lectures, exercises and practical course
5	Participation requirements: Formal: None Content: Computer skills, differential and integral calculus
6	Forms of assessment: Written or oral examination; in each case with preliminary examination performance
7	Prerequisite for the award of credit points: Module examination pass with preliminary examination
8	Application of the module (in the following study programmes) Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Rolf Naumann
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Gender and Diversity: Success Factors for Companies					GUD
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3135	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students ..

- know the terms, history and differences of gender/ gender mainstreaming and diversity/ diversity management.
- know legal principles in the context of gender and diversity (e.g. EU Anti-Discrimination Directive, General Equal Treatment Act)
- are sensitised to human heterogeneity in the corporate context.
- independently recognise stereotyping and can develop ideas for possible changes in the business environment.
- are able to independently collect relevant information on established concepts such as gender mainstreaming and diversity management and to assess their relevance for professional practice.
- are familiar with selected theories and approaches in the current discourse on diversity management and, building on this, are able to develop conceptual ideas for the implementation of holistic diversity management in a corporate context.

3 Contents:

- Definitions and delimitation of gender and diversity Concepts and approaches to equal opportunities (e.g. diversity management, gender mainstreaming)
- Legal bases and political influences (e.g. EU Anti-Discrimination Directive). General Equal Treatment Act (*German* abbreviation: AGG))
- Subjective and social values, attitudes and prejudices in the context of diversity
- Possible approaches for taking diversity characteristics (e.g. gender and age) into account in selected areas of business (marketing, product development, human resources)
- Concept for the sustainable introduction of holistic diversity management
- Case studies and application examples from business practice

4 Forms of teaching:

Lecture, sem. lessons, presentation, group work, presentation of seminar paper

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
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.), Biotechnology and Instrumentation Engineering (B.Sc.), Electrical Engineering (B.Eng.), Computer Engineering (B.Eng.), Mechanical Engineering (B.Eng.), Mechatronics (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Andrea Kaimann
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

High-Frequency Electronics					HFE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1101	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

After completing the module, students will be able to:
- name, calculate and understand all common four-pole parametres for the description of linear components in AC and high-frequency technology,
- select and apply the measurement technique for determining four-pole parameters and evaluate the measurement results produced,
- explain the state of "wave matching" of linear high-frequency systems and design the necessary system boundary conditions,
- explain components of high-frequency electronics and select them for the specific application

3 Contents:

- Four-pole theory for the description of linear circuits
- Leadership theory
- Shaft adjustment
- Standardised power waves / scattering parameters
- The Smith Chart
- Components of high-frequency electronics
- Laboratory practicals in small groups

4 Forms of teaching:

Lecture, sem. lessons, laboratory practicals in small groups.

5 Participation requirements:

Formal:	None
Content:	Mathematics 1 (1146 or 1147) and 2 (1152 or 1153). Electrical Engineering 1 (1071 or 1072) and 2 (1075)

6 Forms of assessment:

Written or oral examination; in each case with preliminary examination performance

7 Prerequisite for the award of credit points:

Module examination pass with preliminary examination

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

Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10	Module coordinator: Prof. Dr.-Ing. Rüdiger Schultheis
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Industrial Engineering / Lean Management					INLM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1102	150 h	5	6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students

- Are able to explain the basic idea and philosophy of lean management and lean production. They also recognise the relationship between Industrial Engineering and Lean Management and understand that the topics complement each other in a meaningful way.
- Are able to identify waste in the company.
- Understand typical lean methods and tools and understand how they relate to operational applications. They can also apply the acquired methodological knowledge for simple practical cases.
- Are able to describe, plan and improve work systems in the company, taking into account ergonomic, technical and work organisation aspects, as well as determine and use actual and target data on work and production systems, e.g. quantity and times.

3 Contents:

1. Introduction, definition and delimitation of Industrial Engineering, Lean Managmenet and Lean Production
2. Basics of work and production systems
3. Value, value creation and waste
4. Standards, Kaizen
5. Flow, takt, pull
6. Levelled production, fast set-up
7. Total productive maintenance, shopfloor management
8. Quality, problem solving
9. Value stream analysis and design
10. Lean administration and lean development
11. Systematics for the planning and design of work and production systems
12. Selected methods for data acquisition and data evaluation
13. Selected rules, methods and tools for working system design
14. Compensation and motivation

4 Forms of teaching:

Lecture, sem. lessons with exercises, practical course, guest lecture

5 Participation requirements:

Formal:	None
Content:	None

Forms of assessment:

6	Written exam, 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 (B.Sc.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Magnus Horstmann
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Sales and Distribution Management 1 – Industrial Goods Marketing					IGM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1275	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	3	weekly hours	45	h	67.5	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

After attending the lecture, students will be able to

- name and explain the characteristics and systematisation alternatives of industrial goods marketing as well as the central contents of type-specific marketing and cross-type approaches.
- classify the contents of industrial goods marketing in the context of the knowledge of marketing fundamentals acquired in other courses and to identify differences.
- apply the special features and tasks of industrial goods marketing to selected practical examples and case studies and independently solve the associated tasks and present the results.
- critically reflect on the special features and tasks of industrial goods marketing.
- recapitulate the course content independently and deepen their knowledge through self-study. Ideally, they form learning groups which last throughout the entire period of study.

3 Contents:

1. Building blocks of marketing, especially characterisation of industrial goods marketing
2. Type-specific marketing and selected problems: The branding of (a) raw and input materials, (b) parts and assemblies, (c) single units, (d) plants, (e) systems
3. Cross-type approaches for the realisation of sustainable competitive advantages in the business-to-business field

4 Forms of teaching:

Lecture, sem. lessons with exercises, case examples/case studies

5 Participation requirements:

Formal:	None
Content:	Knowledge of the module Marketing (1143)

6 Forms of assessment:

Written examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Mechatronics (B.Sc.) and Industrial Engineering and Management (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. oec. Klaus Rüdiger
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Computer Science 1 – Imperative Programming					IN1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1106	150 h	5	1st sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students are able to present algorithms independently of the programming language. They can independently create small programmes using the programming language C. They are able to understand C programmes written by others. Students know the basic elements of imperative programming and can apply them in programming. Students are familiar with the basic data types of imperative programming languages and are able to define composite data types.

3 Contents:

Teaching content:

- Formal foundations of computer science (set theory, Boolean algebra, propositional logic, Turing machine, decidability, von Neumann architecture)
- Algorithms and representation of algorithms
- The programming language C and its standard libraries
- Basic data types, composite data types and operators
- Expression and instruction
- Control structures of imperative programming (blocks, loops, conditional statement)
- Functions, scopes and recursions
- Efficiency of algorithms

4 Forms of teaching:

Lecture, sem. lessons with exercises, practical course

5 Participation requirements:

Formal:	None
Content:	None

6 Forms of assessment:

Written examination, combination examination, performance 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)

Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. rer. nat. Martin Hülse

11 Other information:

Literature and other sources will be announced at the beginning of the course

12	Language: German

Computer Science 2 – Object-Oriented Programming					IN2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1110	150 h	5	2nd sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students are able to analyse, abstract and model tasks in the field of digital data processing and to implement and test them programmatically. Independent of a specific programming language, they are able to apply the concepts of object-oriented programming in software development. The students are able to efficiently implement small software projects using the object-oriented programming paradigm with the programming language C++. They can apply standard algorithms and data structures to concrete problems in SW development and are able to assess the programmes developed in terms of their efficiency.

3 Contents:

Teaching content:

- Abstract data type
- Concepts of object-oriented programming (abstraction, data encapsulation, polymorphism, inheritance)
- Modelling language UML
- Unit tests and test-driven SW development
- Brief introduction to SW engineering (idioms, design patterns, architectures)
- Algorithms and data structures

4 Forms of teaching:

Lecture, sem. lessons with exercises, practical course

5 Participation requirements:

Formal:	None
Content:	Computer Science 1

6 Forms of assessment:

Written examination, combination examination, performance 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)

Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. rer. nat. Martin Hülse

11 Other information:

Literature and other sources will be announced at the beginning of the course.

12	Language: German

Computer Science 3 – Software Architectures for Physical Computing					IN3
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1316	150 h	5	3rd sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students are able to analyse the interaction of sensor-motor systems and develop concepts for 1) the digital acquisition and processing of sensor data and 2) the control of actuators.
Students are able to work out and evaluate system architectures for concrete distributed sensor-motor systems.
The students are able to design, build and programme simple sensor-motor units.

3 Contents:

Teaching content:

- Concepts and frameworks for the integration of hardware and software
- Distributed systems: Basics, architectures, bus systems, protocols, middleware, IT security
- Internet of Things (IoT) in the industrial environment
- Industry 4.0
- Development systems for physical computing (IDEs)
- Introduction to working with IDEs
- Basics of electronics for IoT
- Basics of programming sensor-motor units
- Implementation of simple sensor-motor units
- Application examples of machine learning methods for the intelligent control of sensor-motor units

4 Forms of teaching:

Lecture, sem. lessons with exercises, practical course

5 Participation requirements:

Formal:	None
Content:	Computer Science 2

6 Forms of assessment:

Written examination, combination examination, performance 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)

Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. rer. nat. Martin Hülse

11 Other information:

12	Language: German

Innovation and Change Management					IVM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1113	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students are able to describe different innovation and change processes in the company. They can independently and action-oriented apply suitable methods for planning, organising and implementing innovation and change processes. The students can assess the complexity of the processes and select suitable procedures that can be implemented with step-by-step problem solving. The course enables the students to act independently in the field of innovation and change environment in which a company operates.

3 Contents:

- Innovation and innovation management
- Innovation process the early phases (emergence of innovations)
- Innovation process the late phases (process control, success assessment)
- Product management and intellectual property rights
- Change management, boundary conditions and success factors
- Methodical management of innovation and change
- Cooperation in innovation and change teams
- The market as a driver of innovation and change

4 Forms of teaching:

Lecture, sem. lessons

5 Participation requirements:

Formal:	None
Content:	None

6 Forms of assessment:

Written exam, combination exam, performance 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 (B.Sc.) and Industrial Engineering and Management (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Manuel Knüppel

11 Other information:

Literature will be announced at the beginning of the course.

12	Language: German

Integrated Product Development					IP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1232	150 h	5	4th or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The students distinguish between different product development processes and know different development methods and tools. They can select and apply these methods in a targeted manner. They are able to work methodically, systematically and purposefully on a technical problem area and apply guiding rules for methodical development.
3	Contents: Methodical development of products (based on VDI 2206, 2221, 2222, among others) Planning, tasks, specifications/requirements list, development structuring -> Overall function, sub-functions, functional structure, Idea generation/creativity process -> Overview of methods, discursive and intuitive methods, evaluation of alternative solutions, evaluation procedures. Selected development guidelines (e.g. cost-conscious development, design in accordance with stresses)
4	Forms of teaching: Lecture, sem. lessons, practical exercises
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
8	Application of the module (in the following study programmes) Biotechnology and Instrumentation Engineering (B.Sc.), Engineering Computer Sciences (B.Eng.), Mechanical Engineering (B.Eng.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Klaus Dürkopp
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Sensors and Actuators					ISS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1311	150 h	5	6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

In relation to the contents listed below, the students can classify and assess sensors as essential components of mechatronic systems. They can select and configure sensors suitable for mechatronic production processes in a targeted manner, and design and develop sensors relevant for mechatronic products. They confidently apply the necessary means and methods of describing sensor systems as an essential step in overall system design. The students use the basic knowledge of signal processing in the field of sensor technology to design intelligent sensor systems. They analyse trends and current fields of application in the area of modern sensor technology and the associated development methodology.

3 Contents:

Sensors:
Definition of terms, categorisation according to transducer technologies, categorisation according to applications, sensor characterisation (accuracy, resolution, sensitivity, linearity)
Sensor signal chain:
Signal processing and conditioning, design and realisation of analogue filters, ADU/DAU, sampling theorem
Sensor signal processing:
Sensor error correction, discrete-time processing of analogue signals, spectral analysis/FFT, windowing, design and implementation of digital filters
Construction of technical sensor systems:
Integration levels, intelligent sensors, indirect/virtual sensors, aspects of embedded systems (mC, DSP, FPGA), connectivity/network connection
Development methodology and applications

4 Forms of teaching:

Lecture, sem. lessons with computer exercises, practical course

5 Participation requirements:

Formal:	
Content:	Electrical Engineering (1073 and 1076 Mechatronics. 1070 Engineering Computer Sciences, 1070 Industrial Engineering and Management), Electronics (1063 Mechatronics. 1067 and 1069 Engineering Computer Sciences, 1065 Industrial Engineering and Management), Electrical Engineering 2

6 Forms of assessment:

Written examination, combination examination, performance 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) Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.), Mechatronics (B.Sc.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Joachim Waßmuth
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

International Management/Marketing					IMM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1115	150 h	5	6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	32	h	43	h
	Sem. lessons	30 students	2	weekly hours	32	h	43	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

After attending the lecture, students will be able to

- name and explain the importance of international market development for the success of a company and the associated special features and tasks of international marketing.
- classify the special features and tasks of international marketing in the context of the knowledge of marketing basics acquired in other courses and identify differences.
- apply the special features and tasks of international marketing to selected practical examples and case studies and independently solve the associated tasks and present the results.
- critically reflect on the special features and tasks of international marketing.
- recapitulate the course content independently and deepen their knowledge through self-study. Ideally, they will form learning groups that last throughout the entire study period.

3 Contents:

Introduction to International Marketing

- Coordination in the context of international market development
- Environmental analysis
- Risk analysis
- Planning marketing objectives
- Market entry decisions
- Marketing instruments in international marketing

4 Forms of teaching:

Lecture, sem. lessons with exercises, case studies/ case studies

5 Participation requirements:

Formal:	None
Content:	Knowledge of the contents of the module Marketing (1143) Knowledge of English

6 Forms of assessment:

Written examination

7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Engineering Computer Sciences (B.Eng.), Mechatronics (B.Sc.) and Industrial Engineering (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. oec. Klaus Rüdiger
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Colloquium					KOL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1290	90 h	3	6th or 7th sem.	Each semester	

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	90	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The colloquium is to be assessed as an independent examination. It serves to determine whether the candidate is capable of orally presenting and independently justifying the scientific topic of the bachelor thesis, its subject-related foundations, its interdisciplinary connections and its non-subject-related references, as well as its significance for practical applications.
3	Contents: - Content of the thesis according to the topic - Disputation on the procedure in the preparation of the thesis and the questions that arose in the context of the thesis
4	Forms of teaching: Oral examination for the bachelor thesis
5	Participation requirements: Formal: None 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) Applied Mathematics (B.Sc.), Biotechnology and Instrumentation Engineering (B.Sc.), Electrical Engineering (B.Eng.), Computer Engineering (B.Eng.), Mechanical Engineering (B.Eng.), Mechatronics (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: N.N.
11	Other information:
12	Language: German

Engineering Designing With Plastics					KMK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1123	150 h	5	4th or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	1	weekly hours	15	h	22.5	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The students are able to design components made of plastic in a way that is suitable for the material and the tool. They can assess the properties of plastics in processing and use and thus select suitable materials for a specific application. They know the necessary tooling techniques and can design a simple tool to manufacture an injection-moulded part.
3	Contents: - Plastics as construction materials, special properties - Manufacturing (processes, especially injection moulding) - Process simulation, application - Material mechanics, material selection with databases - Moulds (construction and standards, tempering, demoulding) - General design rules
4	Forms of teaching: Lecture, exercise, practical course
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written exam or combination exam
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Mechanical Engineering (B.Eng.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Christoph Jaroschek
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Mechanical Design 1					KM1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1125	150 h	5	2nd sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students know the basic features of design and have an overview of machine elements. They understand applied strength principles and the basic material behaviour of metals. This enables them to carry out practical strength checks and recalculations of selected connection methods and machine elements. It is possible for the students to develop and assess solutions for constructive tasks themselves by applying the knowledge they have gained.

3 Contents:

Fundamentals of Design
Material Strength
Time and fatigue strength calculations
Axles and shafts
Basics of bearing arrangements
Rolling bearing
Material-, form- and friction-locking connection methods

4 Forms of teaching:

Lecture, seminar, practicals

5 Participation requirements:

Formal:	None
Content:	None

6 Forms of assessment:

Term paper, written exam, combination exam, performance exam, oral exam or exam 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 (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Klaus Dürkopp

11 Other information:

Literature will be announced at the beginning of the course.

12 Language:

German

Mechanical Design 2					KM2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1126	150 h	5	3rd sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students know the characteristics, advantages and disadvantages of selected machine elements and can use and design them in a targeted manner in constructions. They can design and dimension drive systems with different requirements. By combining and varying construction elements, the participants are able to design, analyse and develop different solutions to be weighed against each other.

3 Contents:

Shaft-hub connections
Extended dimensioning of rolling bearings
Plain bearings
Belts and chains
Gears and gearing
Calculation, construction and design of a product example

4 Forms of teaching:

Lecture, seminar, practicals

5 Participation requirements:

Formal:	None
Content:	Participation in the module 'Mechanical Design 1' (1125)

6 Forms of assessment:

Term paper, written exam, combination exam, performance exam, oral exam or exam 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 (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Klaus Dürkopp

11 Other information:

Literature will be announced at the beginning of the course.

12 Language:

German

Construction Basics					KG
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1129	150 h	5	1st sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The students have a basic knowledge of materials science as well as knowledge of technical representation methods, know the basics of standardisation, dimensioning and tolerancing and can independently create simple constructions and represent them in accordance with standards. The students master the use of a 3D CAD system and can independently create solids and assemblies as well as derive 2D drawings. They understand technical drawings and know different possibilities of construction analysis with the CAD system. Students are able to structure complex designs independently and master the basics of creating design documentation
3	Contents: Standardisation. Drawing reading. Dimensional, shape and positional tolerances. Fits. technical surfaces. Fundamentals of Materials Science. Structure and functioning of CAD systems. Input and processing of geometric data. Application of CAD systems, documentation of constructions. Methods of design analysis
4	Forms of teaching: Lecture, exercise, practical course
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written examination, performance 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) Biotechnology and Instrumentation Engineering B.Sc. and Mechatronics B.Sc.
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Herbert Funke
11	Other information: Literature: Hoischen: Technisches Zeichnen; Labisch: Technisches Zeichnen, various DIN standards Further literature will be announced at the beginning of the course.

12	Language: German

Plastics Technology					KT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1134	150 h	5	2nd or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students know the history and the economic importance of plastics. They understand the connection between technical progress and economic use. They know how plastics are produced and technically processed. They can assess for which technical application a plastic is suitable and can select or critically evaluate suitable manufacturing processes for component production. The students can apply the theoretically acquired knowledge in practice for the interpretation of practical/experimental results. Students can also classify or evaluate the use of plastics from a sustainability perspective.

3 Contents:

- History of plastics, economic significance
- General differences to metals
- Model conception and morphology (structural design)
- Microstructures, crystallisation conditions
- Synthesis of plastics
- Mechanical behaviour (modulus of elasticity, creep modulus)
- Rheology (flow properties, viscosity and viscosity models)
- Processing method
- Influence of processing on the material/component properties
- Selection of material for specific applications
- Use of plastics under sustainability aspects

4 Forms of teaching:

Lectures, seminar, practical course

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

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

Mechanical Engineering B.Eng. and Mechatronics B.Sc.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Bruno Hüsgen

11 Other information:

Literature will be announced at the beginning of the course.

12	Language: German

Logistics					LOG
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
1142	150	5	4th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students are familiarised with the logistics function in companies and externally. They are familiar with the application-orientated design options in the logistics subsystems as well as the corresponding design methods. The students are able to use operative and strategic logistics instruments in a target-orientated manner and thus efficiently direct and control operational and inter-company logistics processes.

Logistical problems can be modelled, calculated and optimised using suitable methods.

3 Contents:

Goals, tasks and functions of logistics management
- Logistics planning and organisation
- Supply Chain Management
- Multimodal transport systems
- Operational logistics
- Procurement logistics
- Warehouse logistics
- Order picking
- Production logistics
- Distribution logistics
- Analysis and calculation methods in logistics
- Key figure systems

4 Forms of teaching:

Lecture, sem. lessons with exercises

5 Participation requirements:

Formal:	None
Content:	None

6 Form of assessment:

Written examination, combination examination, performance 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):

Industrial Engineering and Management B.Sc.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Manuel Knüppel

11 Other information:

Literature will be announced at the beginning of the course.

12	Language:
	German

Mathematics 1					MA1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1149	150 h	5	1st sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Students are familiar with the mathematical way of working. Simple to moderately difficult mathematical problems can be solved independently. Students are able to apply the methods and procedures they have learned and their mathematical correlations to technical problems and to work out solutions to these problems.
3	Contents: - Number systems and algebraic equations, amount equations - Definition of functions and curves, basic terms - Limit value and continuity - Important functional classes - Complex numbers and their application - Differentiating a function and its rules, curve discussion - Integration - Application to technical issues
4	Forms of teaching: Lecture, sem. lessons with exercises
5	Participation requirements: Formal: None Content: Knowledge of school mathematics
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) Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Rolf Naumann
11	Other information: Literature will be announced at the beginning of the course. Papula, Mathematik für Ingenieure und Naturwissenschaftler, Bd. 1 und Bd. 2
12	Language: German

Mathematics 2					MA2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1155	150 h	5	2nd sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Based on the acquired knowledge from Mathematics 1, students can describe and solve complex multidimensional problems from technology and natural sciences using mathematical methods. The ability to think abstractly and to find solutions are further developed.
3	Contents: - Basic concepts of vector algebra and applications in geometry - Linear algebra: Calculator operation with vectors and matrices - Linear systems of equations and eigenvalue problems - Multidimensional differential calculus with applications - Integration of rotationally symmetrical bodies, arc lengths,
4	Forms of teaching: Lecture, sem. lessons with exercises
5	Participation requirements: Formal: None Content: Module Mathematics 1 (1149)
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) Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Rolf Naumann
11	Other information: Literature will be announced at the beginning of the course. Papula, Lothar, Mathematik für Ingenieure und Naturwissenschaftler, Bd. 1 und Bd. 2
12	Language: German

Mathematics 3					MA3
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1160	150 h	5	3rd sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The students are able to apply ordinary differential equations and their mathematical relationships to technical problems and to work out solutions using various methods.
3	Contents: - Description of ordinary differential equations of 1st order and their solutions - Linear differential equations of 2nd order with constant coefficients - Example from mechanics and electrical engineering - Systems of linear differential equations with constant coefficient - Solution with the help of eigenvalues and eigenvectors - Numerical solution methods for non-linear differential equations - Description of functions and DGL in the Laplace domain - Introduction to Vector Analysis
4	Forms of teaching: Lecture, sem. lessons with exercises
5	Participation requirements: Formal: None Content: Module Mathematics 2 (1155)
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) Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Rolf Naumann
11	Other information: Literature will be announced at the beginning of the course. Papula, Lothar, Mathematik für Ingenieure und Naturwissenschaftler, Bd. 2 und Bd. 3
12	Language: German

Mechatronics					ME
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1164	150 h	5	6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Technical content: multiple input multiple output (MIMO) systems, mechanical transmission elements, motion diagrams. Description of harmonic oscillations. Structure, operating behaviour and the control loops of actuators and sensors.

Skills: Determination of MIMO systems, modeling of mechanical system components. Understanding the vibration behaviour of machines and vehicles. Experimental determination of natural vibration parameters, analysis of vibration problems, determination of possible constructive solutions. Determination of harmonic oscillations from measurements (Fourier analysis).

Understanding of mechatronic systems. Selection of the sensors and actuators suitable for the respective operating conditions. Ability to estimate and calculate the static and dynamic parameters of the overall system.

Software tools: Matlab, Simulink.

3 Contents:

Examples of mechatronic systems, MIMO systems, identification of MIMO systems, mechanical components as a system, mechanical energy conductors, energy conductors for translational movements, energy conductors for rotational movements, mechanical converters, transmission, engines, driven machines, motion diagrams. Description of oscillations. Fourier transform. One-mass, two-mass and three-mass oscillators: Equations of motion, natural frequencies and natural modes of vibration. Properties of the natural oscillations. Servo systems, inverter drives, linear motors, magnetic drives, stepper motor drives, piezo and shape-memory alloy (SMA) actuators, pneumatic, hydraulic and magnetostrictive actuators, micromechanical systems for actuators and sensors.

4 Forms of teaching:

Lecture, sem. lessons, practical course

5 Participation requirements:

Formal:	None
Content:	None

6 Forms of assessment:

Written examination, combination examination, performance 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)

	Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Peter Reinold
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Measuring Technology					MT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1168	150 h	5	3rd sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Describe the basic structure of measuring equipment and frequently used measuring methods or sensors; select the measuring methods suitable for the respective conditions of use; determine measuring uncertainties; determine possible disturbance variables and select precautions to reduce them; basic principles of the development of a computer-assisted system for processing measured values.
3	Contents: Principle of measurement, SI units, structure of technical measuring equipment, measurement errors, measurement uncertainties, disturbance variables and their reduction, analogue and digital signals, general aspects for the selection and use of measuring transducers, time and frequency measurement, current, voltage and power measurement, length, angle and strain measurement, force, torque, temperature and pressure measurement methods, computer-assisted system for processing measured values.
4	Forms of teaching: Lecture, sem. lessons with exercises and project tasks, practical course
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written examination, combination examination, performance 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) Biotechnology and Instrumentation Engineering (B.Sc.), Mechatronics (B.Sc.) and Industrial Engineering (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. Dr. Andrea Ehrmann
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Microcontrollers					MC
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
1173	150	5	Fifth semester	Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students understand how a microcontroller works and assess possible applications and limitations. They will build microcontroller circuits in the laboratory according to a given circuit diagram, scrutinise the design and evaluate it using measurement techniques. The students create simple programs in C and Assembler, extend the programs and put the software into operation on the target hardware with the help of programming devices. They analyse and debug the software on the target hardware with the help of modern development environments.

3 Contents:

Overview and comparison of type families.
Structure and mode of operation of a microcontroller using the example of a current 8-bit controller.
Command set and on-chip peripherals, connection of external peripherals.
Introduction to machine language and assemblers.
Programming in C.
Solution of frequently occurring tasks in consideration of the technical and economic aspects.

4 Forms of teaching:

Lecture in seminar style with blackboard writing and projection, accompanying seminar. Practical course in the laboratory.

5 Participation requirements:

Formal:	
Content:	Modules Digital Electronics I and II (Engineering Computer Sciences study programme, 1070 and 1045) or Electronics (Electrical Engineering study programme, 1068) should have been completed. Modules: 1045 Digital Electronics II; 1070 Digital Electronics I; 1325 Electrical Engineering Basics

6 Form of assessment:

Written or oral examination; in each case with preliminary examination performance

7 Prerequisite for the award of credit points:

Module examination pass with preliminary examination

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

Electrical Engineering B.Eng. and Engineering Computer Sciences B.Eng

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Thomas Hesse

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

Network Technology					NW
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1181	150 h	5	3rd or 5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

- Students explain the basics of setting up local area networks (LAN).
- Students have a basic knowledge of the protocols used. They plan and simulate simple networks, set them up in the laboratory with a partner, configure the network devices used (router, switch, PC) and discuss the results of their work.
- The students assign the processes in an IP network to the layers of the OSI or the TCP/IP model. They can detect and eliminate configuration errors in a LAN.
- Students are familiar with the role of a switch and configure virtual LANs (VLAN).
- The students name possibilities to protect a LAN from non-authorised attacks (e.g. hackers).

3 Contents:

- Architecture and application of computer-aided communication systems,
- Media for data transmission,
- Local networks and their characteristics,
- Subnet formation also with variable subnet lengths (VLSM),
- Protocols of data transmission in networks (network and transport layer),
- Function of important network coupling devices (especially router, switch),
- Configuration of active components for setting up networks,
- Application level services and protocols,
- Simulation and practical construction of computer networks.

4 Forms of teaching:

Lecture, sem. lessons, project and group work within the framework of the internship

5 Participation requirements:

Formal:	None
Content:	None

6 Forms of assessment:

Written examination, combination examination or oral examination; each with preliminary examination performance

7 Prerequisite for the award of credit points:

Module examination pass with preliminary examination

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

Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Lutz Grünwoldt
11	Other information: Literature will be announced at the beginning of the course. Lecture notes will be provided. Each student will be a member of a Cisco class and will have access to a simulation environment and extensive online curricula. Certificates can be issued for successful participation in Cisco final exams.
12	Language: German

Photonics					PHO
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1309	150 h	5	4th or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	1	weekly hours	15	h	30	h
	Practical or seminar	15 students	1	weekly hours	15	h	15	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Name and explain the basic concepts, elementary relationships and laws of photonics. Demonstrate and apply the basic means of description and methods of analysis, especially in light technology, laser technology and technical optics. Name the most important areas of application. Grasp the practical significance of photonics and developments driven by photonics. Naming, interpreting and designing interacting light-generating and light-directing components. Enable the development of independent solutions in application areas of photonics.
3	Contents: Historical overview and current developments in optics, definitions of terms, quantities, units, laws and standards. Spectral eye sensitivity and photometric radiation equivalent, geometric optics, wave optics, photometry, laser effect, holography and interferometry, simulation of optical beam paths, handling of optical laboratory systems. Applications in metrology, production technology, material processing, biotechnology and medical technology.
4	Forms of teaching: Lecture, exercise and practical course
5	Participation requirements: Formal: Content:
6	Forms of assessment: Written examination, Combination examination, Performance 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) Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Reinhard Kaschuba
11	Other information: The course material is summarised in a lecture-accompanying script, an exercise catalogue, a collection of pictures and a collection of formulas. A current literature review will be presented in the first lecture hour.

12	Language: German

Physics					PHY
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1319	150 h	5	2nd sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	30	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	15	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Explain basic physical processes and laws in the fields of mechanics, fluid mechanics, thermodynamics, oscillations, optics and acoustics.
Scientific performance and analysis of experiments to verify theoretical facts.

3 Contents:

Mechanics (kinematics: one and three-dimensional translation; dynamics: Newton's axioms, different forces, work, energy, power, momentum.
Fluid mechanics (hydrostatics: pressure, buoyancy; hydrodynamics: continuity equation, Bernoulli equation, laminar and turbulent flow, friction).
Thermodynamics (temperature, heat, thermal expansion, gas laws, internal energy, entropy, circular processes, phase transitions).
Vibrations and waves (free damped and undamped vibrations, forced vibrations, superposition of vibrations, harmonic waves, Doppler effect, interference, diffraction).
Optics (geometric: reflection, refraction, lenses; wave optics: interference, diffraction).
Acoustics (sound wave, sound level, sound spectra, sound propagation).

4 Forms of teaching:

Lecture, sem. lessons with exercises and project tasks, practical course

5 Participation requirements:

Formal:	
Content:	

6 Forms of assessment:

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)

Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. Dr. Andrea Ehrmann

11	Other information:
12	Language: German

Practical Project / Internship					PRA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1292	450 h	15	7th sem.	Each semester	12 weeks

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	450	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: In the work term, the activities and learning outcomes imparted in the course of study are to be applied in a practice-oriented manner. To this end, students should work independently on engineering projects and develop suitable solution strategies. The main aim is to develop and expand integration, analysis and problem solving, presentation and communication skills.
3	Contents: The contents result from the field of activity of the respective chosen company or enterprise and should include an engineering task. At the end of the work term, the supervising company is to prepare an activity report and the students a final report. During the practical phase, the students should receive individual and professional advising from the supervising university lecturers.
4	Forms of teaching: Sem. lessons with exercises as accompanying guidance
5	Participation requirements: Formal: None Content: None
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) Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.), Mechanical Engineering (B.Eng.), Mechatronics (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: N.N.
11	Other information:
12	Language: German

Product and Price Management					PPM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1209	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	3	weekly hours	45	h	67.5	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Students have basic knowledge of the tools of operational marketing and can classify them as practical implementation tools of strategic marketing. They gain knowledge of the methods and design tools of programme, product and pricing policy and can evaluate their possibilities and limits. The students understand the mode of action of the operative market control instruments and can apply them in a targeted manner. Students acquire the competence to develop concepts for the marketing of products throughout their entire life cycle and to evaluate their practicality.
3	Contents: • Overview of the instruments of operational marketing • Programme policy • Product policy • Contracting policy • Basic concepts of distribution policy
4	Forms of teaching: Lecture, sem. lessons
5	Participation requirements: Formal: None Content:
6	Forms of assessment: Written examination, combination examination, performance 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 (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. oec. Klaus Rüdiger
11	Other information: Literature will be announced at the beginning of the course. Renewable Energies study programme: possible elective subject to be chosen
12	Language: German

Production Planning					PRP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1212	150 h	5	4th or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students can apply tools and methods of production planning and control to practice-oriented examples.
They are able to evaluate the planning results in terms of plausibility and efficiency and to assess their impact on holistic business processes between suppliers and customers.
The students understand the procedures in the sub-processes of product planning and are able to evaluate the information exchanged between the sub-processes and to assess it with regard to its effects on other planning steps.

3 Contents:

- Operational tasks in the area of production planning and control
- Connection between development and the production processes to be planned: Product design suitable for production
- Market requirements for production processes and their control
- Typical EDP application areas to support production planning and control
- Information flow and associated data structures in the IT systems (master data management: material master, parts lists, workplace master, routings)
- Programme planning and primary needs assessment,
- Material requirements planning with BOM explosion and net requirements planning
- Scheduling and capacity balancing
- Order processing and production order management,
- Mapping a Kanban control system
- Shipping preparation, delivery and invoicing
- Computer-aided production planning and controlling

4 Forms of teaching:

Lecture and exercise

5 Participation requirements:

Formal:	None
Content:	Basic knowledge of manufacturing processes and basic knowledge of information technology

6 Forms of assessment:

Term paper, 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 (B.Sc.) and Industrial Engineering and Management (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Production Engineering					PRT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1214	150 h	5	3rd or 5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students:

- can define the basic terms of production engineering.
- can classify the most important manufacturing processes for metals and plastics with regard to their process characteristics and limits as well as their advantages and disadvantages.
- have the ability to select suitable manufacturing processes for different tasks and to describe the respective processes.
- are able to determine process-specific characteristic values, to evaluate these competently and, with the help of the results obtained, to assess the various manufacturing processes with regard to their advantages and disadvantages.
- know the essential basics in the field of assembly technology and are able to evaluate and assess the economic and organisational framework conditions of assembly concepts.

3 Contents:

1. Introduction to production engineering
2. Casting and powder metallurgy
3. Injection moulding and extrusion of plastics
4. Sintering and liquid-state sintering of plastics
5. Additive manufacturing processes
6. Solid and sheet metal forming
7. Cutting
8. Machining with geometrically defined cutting edge
9. Machining with geometrically undefined cutting edge
10. Abrasion
11. Joining
12. Coating
13. Finishing of plastics
14. Metal-plastic composites
15. Assembly technology

4 Forms of teaching:

Lecture, sem. lessons

5 Participation requirements:

Formal:	None
Content:	None

Forms of assessment:

6	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) Mechanical Engineering (B.Eng.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Magnus Horstmann
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Project 3 with Design Aspects					PR3
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1224	150 h	5	3rd sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	0	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	2	weekly hours	30	h	120	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The students apply methods and tools for the creation of a sophisticated product or the development of an engineering mechatronic solution. They use project management methods in a self-organised team to distribute tasks and track the progress of work. In the team, work packages of the individual participants are identified, divided up and the interrelationships are shown. The students continuously document project steps and results. They develop a basis for decision-making, evaluate and make decisions. They compile the project result and draw a critical conclusion.
3	Contents: Structuring of tasks in mechatronic product development. Optimisation of tasks and workflows in product development and project work. Target-oriented project management techniques, presentation techniques, technical communication and documentation channels. Practical application of study basics.
4	Forms of teaching: Project
5	Participation requirements: Formal: None Content: None
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
8	Application of the module (in the following study programmes) Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: N.N.
11	Other information:
12	Language: German

Project 4 with Communication Aspects					PR4
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1225	150 h	5	4th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	0	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	2	weekly hours	30	h	120	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students apply methods and tools for the creation of a sophisticated and extensive product or the development of a corresponding engineering mechatronic solution in a self-organised team. They adapt selected project management methods to the complexity of the task structure and the tracking of the work progress and evaluate their own processes. In the team, work packages of the individual participants are identified, divided up and the interrelationships are shown. Results of the individual team members are appreciated, critically questioned and compared. The students continuously document project steps and results and defend them. They develop a basis for decision-making, evaluate and make decisions. They compile the project result and draw a critical conclusion.

3 Contents:

Structuring of more complex task fields in mechatronic product development. Optimisation of larger tasks and work processes in product development and project work. Targeted project management techniques, presentation techniques, technical communication and documentation channels. Dealing with challenging project topics, e.g. conflict management, group dynamics, etc.

4 Forms of teaching:

Project

5 Participation requirements:

Formal:	None
Content:	None

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

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

Mechatronics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

N.N.

11	Other information:
12	Language: German

Specialist Project with Marketing Aspects					PR5
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1297	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	0	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	2	weekly hours	30	h	120	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The students apply methods and tools for the creation of a sophisticated and extensive product or the development of a corresponding engineering interdisciplinary solution in a self-organised team. In doing so, the references to the concerns of practice are elaborated, critically compared and assessed. The team monitors and questions itself as far as possible, defends itself and carries out clear, transparent communication and documentation that does justice to a practical judgement. The students apply, in a targeted and balanced manner, what they have learned in their studies to a complex problem scenario.
3	Contents: Classification of problem areas/project assignments in a superordinate system, e.g. marketing strategy, sales structures, company culture, general technology development, etc. Strategic problem-solving behaviour. Differences and similarities between student projects and industry projects. Potentials of the team in terms of composition (individual level of knowledge), capacity and 'soft skills'
4	Forms of teaching: Project
5	Participation requirements: Formal: None Content: None
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
8	Application of the module (in the following study programmes) Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: N.N.
11	Other information:
12	Language: German

Quality Management					QM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1229	150 h	5	4th or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students are able to

- Define the basic concepts of quality theory.
- Explain the basics of building a quality management system.
- Implement standard requirements for a quality management system in a familiar field of work by being able to identify requirements, formulate goals and describe processes based on the defined terms and principles of quality management.
- Make important business decisions based on basic, relevant statistical methods.
- Classify the industrial application of quality methods and techniques in the product creation process.
- Master the essential quality methods and techniques, such as FMEA, QFD, Poka Yoke, SPC, test planning.
- Understand the systematic and structured application of basic methods from the scope of quality management in the context of improvement projects.
- Systematically identify, eliminate and avoid the causes of errors by selecting and applying the appropriate methods for data collection, data analysis and root cause identification for the intended purpose in order to subsequently react and preventively solve quality problems.
- Assess the role of quality management in development, procurement and production.
- Analyse significant variables and risks with regard to the quality level of a production.
- Evaluate and analyse quality data from production and derive measures for production process optimisation.
- Highlight legal aspects of warranty and product liability.

Contents:

3	1 Understanding quality - The term quality - Quality and its characteristics - Quality management 2 Quality management systems - Standards and models for QM systems - ISO 9000 series of standards - Process orientation 3 Quality tools - Data collection tools - Tools for data analysis 4 Management and creativity tools - Management tools (M7) - Creativity tools (K7) 5 Quality management in development - Kano model - Quality Function Deployment - FMEA 6 Statistical design of experiments - Classical design of experiments - Optimum search procedure - Robust processes according to Taguchi - Improvement strategies according to Shainin 7 Quality controlling - Quality cost models - Quality cost accounting 8 Quality management in procurement - Definition of procurement strategies - Factors of supplier selection - Negotiate quality management contracts - Initial sample testing - Incoming goods inspection 9 Statistical methods in quality management - Sampling and population - Distributions - Visualisation of data - Correlations - Linear regression analysis 10 Six Sigma - Introduction to Six Sigma - DMAIC cycle as a systemic approach 11 Quality management in production - Quality testing - Test equipment management - Proof of suitability of measuring systems - Statistical process control 12 Quality management during field use - Field data management - Isochronous diagram - Weibull analysis
4	Forms of teaching: Lecture, sem. lessons, supplemented by guest lectures

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	
8	Application of the module (in the following study programmes) Biotechnology and Instrumentation Engineering (B.Sc.), Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Magnus Horstmann	
11	Other information: Literature will be announced at the beginning of the course.	
12	Language: German	

Computer Architecture					RA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1231	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

- The students know how modern computer hardware works, especially microprocessors.
- Based on the concept of a Von Neumann computer, students evaluate and analyse various basic architecture concepts.
- The students explain how Von Neumann calculators can be programmed at the machine level.
- They convert number representations between any position systems.
- They explain the representation of integers and floating point numbers in different binary codings.
- They know memory hierarchies and bus systems and advanced architecture concepts.
- They explain the computer architecture of graphics processors and analyse it in comparison to conventional computer architectures.
- They solve small programming tasks using IA-32 assembler.
- They develop small programmes for scientific computing on graphics processors (e.g. using CUDA C).

3 Contents:

- Historical overview of computer architectures
- Von Neumann architecture
- Design of digital computers and their components
- Basic functioning of processors at the register transfer level (especially in the processing of machine instructions)
- Computer arithmetic (ALUs, FPUs, coding of numbers and characters)
- Memory hierarchy (cache)
- Bus systems
- Advanced architecture concepts (pipelines, out-of-order execution, etc.)
- Computer architecture of graphics processors
- Programming in IA32 assembler
- Programming of graphics processors (e.g. via CUDA C)

4 Forms of teaching:

Lecture, sem. lessons (exercises if necessary), practical programming tasks in IA32 assembler, practical tasks for the programming of graphics processors

5	Participation requirements:	
	Formal:	None
	Content:	• Basic computer science and programming knowledge • Basic knowledge of digital technology Modules: 1045 Digital Electronics II; 1070 Digital Electronics I; 1105 Computer Science 1
6	Forms of assessment: 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) Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Wolfram Schenck	
11	Other information: Literature will be announced at the beginning of the course.	
12	Language: German	

Automatic Control Engineering					RT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1234	150 h	5	4th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Name and explain the elementary relationships, basic concepts and laws of control engineering. Recognise and describe the elementary relationships in the structure of control technology solutions. Grasp the practical significance of control engineering. Describe and apply the basic means of describing and analysing control engineering processes. Understanding the practical significance of control technology. Enabling the development of independent solutions in simple control engineering application areas.
3	Contents: Fundamentals of control engineering, components of control engineering, operational amplifiers, system description, transfer elements, normalisation and linearisation, time behaviour of transfer elements, frequency behaviour of transfer elements, locus curves, Bode diagram, Laplace transformation, analysis and synthesis of analogue and digital control loop elements, simulation of control loops, stability, discontinuous controllers, digital controllers, fuzzy controllers, state controllers.
4	Forms of teaching: Lecture, practicals and exercises
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written examination, combination examination, performance 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) Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Reinhard Kaschuba
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Robotics					ROB
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1240	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students know the elementary concepts and basics of standard manipulators. Students master the basic descriptive tools and methods for modelling and calculating the forward kinematics of a kinematic chain. Through the presentation and discussion of current robot systems (incl. mobile robot systems and multimodal sensor systems), the students can grasp both the practical significance of robotics and different approaches to robot development. They will thus become capable of independent engineering thinking and working in robotics and related areas of application.

3 Contents:

Teaching content:
- Manipulators
- Robot kinematics (incl. mathematical foundations)
- Forward and inverse kinematics
- Mobile robots
- Sensors for mobile robots
- Artificial intelligence and robotics
- Behaviour-based robotics
- Learning robots

4 Forms of teaching:

Lecture, sem. lessons with exercises, practical course

5 Participation requirements:

Formal:	None
Content:	Mathematics 1 and 2, Computer Science, Technical Mechanics, Electrical Engineering 1 and 2, Physics

6 Forms of assessment:

Written examination, combination examination, performance 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)

Biotechnology and Instrumentation Engineering (B.Sc.), Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.), Mechatronics (B.Sc.) and Industrial Engineering and Management (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. rer. nat. Martin Hülse

11	Other information: Literature and other sources will be announced at the beginning of the course.
12	Language: German

Simulation Technology					SIM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1244	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students:

- have an overview of the different approaches to model-based development.
- create physical and electrical models and implement them in graphical form (as a block diagram, for example) in a simulation environment (such as MATLAB/Simulink).
- derive simulation parameters from the models and configure the simulation software accordingly.
- simulate physical and electrical models on a computer and evaluate the simulation results.
- compare simulated time curves of a model with the measured signals of a real system and assess the model quality and simulation accuracy.
- can discretise continuous-time models and implement them on an embedded system in the form of difference equations (z-superposition functions).
- understand the essential principles of one-step procedures and evaluate the different procedures in terms of efficiency, stability and accuracy.
- outline and explain one-step procedures (e.g. in the direction field).

3 Contents:

- Introduction to simulation technology.
- Model-based development (software-in-the-loop, model-in-the-loop, hardware-in-the-loop and rapid control prototyping).
- Methods of modelling (types of models, physical modelling and representation in the form of block diagrams).
- Modelling of mechanical systems and electrical circuits.
- Extended state form and introduction of the descriptor form.
- Structural singularities and algebraic loops.
- Introduction in the sampling systems (difference equations and z- transformation)
- One-step procedures (Euler procedure, Heun procedure, family of Runge-Kutta procedures).
- Stability and accuracy of one-step procedures.
- Simulation practical course

4	Forms of teaching: Lecture, sem. lessons with exercises, practical course	
5	Participation requirements:	
	Formal:	None
	Content:	Modules: 1233 Automatic Control Engineering;
6	Forms of assessment: Written or oral examination; in each case with preliminary examination performance	
7	Prerequisite for the award of credit points: Module examination pass with preliminary examination	
8	Application of the module (in the following study programmes) Electrical Engineering (B.Eng.), Engineering Computer Sciences (B.Eng.) and Mechatronics (B.Sc.)	
9	Importance of the grade for the final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Martin Kohlhase	
11	Other information: Literature will be announced at the beginning of the course.	
12	Language: German	

Technical Mechanics 1					TM1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1260	150 h	5	1st sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Subject content: Statics of rigid bodies, bending stress of beams, stress and temperature strain. Skills: Calculation of mechanical loads, design of bending parts Knowledge: modelling of mechanical systems Software tools: Excel, Matlab
3	Contents: Introduction, force, moment. Basic operations. free-body principle. Bearings, degrees of freedom Mechanical equilibrium. Rope, pendulum rod, pulley. Intermediate reactions. Centre of gravity. Internal forces. Hooke's law, temperature strain. Straight beam bending. Second moment of area. Parallel axis theorem.
4	Forms of teaching: Lecture, practicals and exercises
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written examination, combination examination, performance 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 (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Peter Reinold
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Technical Mechanics 2					TM2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1261	150 h	5	2nd sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Technical contents: Kinematics, kinetics Skills: Calculation of plane movements, calculation of movement processes under the impact of forces and moments Knowledge: Understanding kinematic processes Software tools: Excel, Matlab
3	Contents: Straight-line movements. Plane movements. Circular movements. Principle of linear movement, Varignon's theorem. Moment of inertia. Parallel axis theorem. Translation. Rotation. Dynamics of discrete systems. Stiction, friction. Conversion of Energy. Power. Oscillator with one degree of freedom.
4	Forms of teaching: Lecture, practicals and exercises
5	Participation requirements: Formal: None Content: None
6	Forms of assessment: Written examination, combination examination, performance 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 (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Peter Reinold
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Technical English					TEN
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1263	150 h	5	4th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	0	h
	Sem. lessons	30 students	4	weekly hours	60	h	90	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

- Expertise: The students acquire an extended active language competence at the upper B2 level. They have a sound specialist vocabulary of Technical English and can combine it with Business English terminology relevant to their profession.
- Social competence: they develop sensitivity to differences in intercultural communication, especially in English-speaking business environment.
- Methodological competence: They are able to skim specialist texts for essential information and present them shortly and concisely both in speaking and in writing. They establish wider contexts and make a critical assessment.
- Personal competence: They show English fluency and a pro-active approach to managing authentic English sources.

3 Contents:

- Students can actively participate in international conferences.
- They master engineering-relevant terminology (e.g. manufacturing processes; mathematical operations; dimensions and shapes; forces and mechanisms; properties of materials; automated systems and Industry 4.0).
- They possess interdisciplinary skills (e.g. discussing readings and trends; pitching a technical product; managing projects; designing conference posters; academic writing).

4 Forms of teaching:

Sem. lessons / individual and group work, etc. / semester project (Assignment)

5 Participation requirements:

Formal:	Regular attendance (70%) and active participation
Content:	English language competence: B1.2 (according to the European Reference Framework for Languages)

6 Forms of assessment:

Combination examination

7	Prerequisite for the award of credit points: Passed semester project and written exam
8	Application of the module (in the following study programmes) Biotechnology and Instrumentation Engineering (B.Sc.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Linda Schmidt
11	Other information: Literature will be announced at the beginning of the course. Textbook, additional materials, intranet self-study courses
12	Language: English

Textile Technologies					TEX
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
6004	150 h	5	4th or 6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Describing the textile chain, comparing different textile fabrics and materials, indicating the most important textile testing procedures and recent research topics. Students describe, analyse and assess a topic from the textile chain independently.
3	Contents: Textile chain: primary spinning, secondary spinning, weaving, warp and weft knitting, braiding, narrow textiles, finishing, manufacture; textile machines; sustainability in the textile chain; intelligent/functional textiles; physical and other properties of textiles; standards; textile testing instructions. Recent research topics along the textile chain.
4	Forms of teaching: Lecture, hands-on seminar
5	Participation requirements: Formal: Content:
6	Forms of assessment: Project work
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Biotechnology and Instrumentation Engineering (B.Sc.), Mechatronics (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. Dr. Andrea Ehrmann
11	Other information:
12	Language: English

Sales and Distribution Management 2					VM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1276	150 h	5	6th sem.	Annual (Summer)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	3	weekly hours	45	h	67.5	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

After attending the lecture, students will be able to

- name and explain the central contents of the lecture.
- place the course content in the context of the knowledge of marketing basics acquired in other courses and identify differences.
- apply the central contents to selected practical examples and case studies and independently solve the associated tasks and present the results.
- critically reflect on the special features and tasks of sales and distribution management.
- recapitulate the course content independently and deepen their knowledge through self-study. Ideally, they form learning groups, which last throughout the entire period of study.

3 Contents:

1. Introduction – Distribution and sales in the context of marketing: from distribution management to distribution and sales management
2. Sales management as a component of the basic strategic concept
3. Sales management as a component of the marketing mix: Basics of operational sales management
4. Sales management in consumer goods markets
5. Sales management in industrial goods markets
6. Business relationship management (CRM Customer Relationship Management)
7. Foundations of selling

4 Forms of teaching:

Lecture, sem. lessons with exercises, case examples/case studies

5 Participation requirements:

Formal:	None
Content:	ideally, knowledge of the contents of the module Marketing (1143)

6 Forms of assessment:

Written examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Mechatronics (B.Sc.) and Industrial Engineering and Management (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. oec. Klaus Rüdiger
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Elective Module					WM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
9002	150 h	5	5th or 6th sem.	Each semester	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students		weekly hours		h		h
	Sem. lessons	30 students		weekly hours		h		h
	Exercise	20 students		weekly hours		h		h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students		weekly hours		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 (B.Sc.)	
9	Importance of the grade for the final grade:	
10	Module coordinator: Prof. Dr.-Ing. Klaus Dürkopp	
11	Other information:	
12	Language: German	

Materials and Component Testing					WBP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1278	150 h	5	3rd or 5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	2	weekly hours	30	h	45	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students are able to evaluate material parameters with regard to their significance for technical applications, taking into account the production of samples and the determination of parameters. For this purpose, students acquire knowledge about different testing and examination procedures. In addition, they can assess the transferability of material parameters to component design or component testing. The students are able to apply suitable test procedures for the analytical examination of component failures and material characteristics efficiently. They can systematically detect a component failure or analyse a sub-problem and derive suitable measures for improvement. They will learn to develop a test procedure in a team and to present and apply it accordingly. They will learn to process an examination assignment effectively and efficiently in coordination with other students.

3 Contents:

- Importance of material and component parameters for design, simulation and production,
- Legal regulations, standards, directives, customer requirements, specifications and functional specifications
- Influence of specimen manufacture, specimen geometry, test method and test parameters on the characteristic values
- Technological, thermal, rheological, optical, acoustic and radiation-related as well as electrical and electromagnetic material and component testing,
- Material identification, chromatography, mass spectroscopy
- Methods for the investigation of ageing, weathering and media resistance
- Basics of damage analysis
- Measuring equipment/test gauge skills
- Design of experiments
- Problem-solving methods
- Processing a damage

4 Forms of teaching:

Lectures, exercises, 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

Application of the module (in the following study programmes)

8	Mechanical Engineering (B.Eng.) and Mechatronics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Bruno Hüsgen
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Materials Engineering					WT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
1281	150	5	2nd semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students understand the relationships between material structure and material properties. They know different possibilities for changing material properties and have the competence to evaluate materials comparatively using material parameters and to select them appropriately for the application. They can analyse the material behaviour taking into account external stresses.

They can apply their knowledge in practical experiments.

3 Contents:

- Material structure (metals/atomic, plastics/molecular)
- Mechanical properties of metals and polymers
- Material behaviour (static/dynamic loads)
- Material changes (heat treatments, constitution)
- Material designations
- Environmental influences (corrosion, media resistance, ageing of plastics)
- Composites and light metals (lightweight construction)
- Materials testing

4 Forms of teaching:

Lecture, seminar, practical course

5 Participation requirements:

Formal:	None
Content:	None

6 Form of assessment:

Written examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Industrial Engineering and Management B.Sc.

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr.-Ing. Brigitta Gänsicke

11 Other information:

Literature will be announced at the beginning of the course.

12 Language:

German