Appendix B: Module catalogue

for the study programme Industrial Engineering and Management (work-integrated) B.Eng.

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

Bachelor Thesis					**BA**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3133	360 h	12	7th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	0	SCH	0	h	360	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

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

Procurement, Production and Logistics					**BPL**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3333	150 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students can explain the functions of “procurement,” “production” and “logistics” in a differentiated way and understand their interrelationships as well as the weaknesses of these functions. With the help of the selected contents and methods, they can recognise and properly assess real economic tasks and problem areas in particular and independently develop approaches to solutions.
Students will be able to carry out a sound supplier evaluation and selection and, based on production planning, investigate suitable sourcing concepts and decide which scientific method is appropriate for sourcing and demand calculation. They can systematically analyse procurement markets to increase their transparency and recognise developments relevant to procurement.
Students learn about basic production systems and can evaluate their applicability for specific industries. They can independently calculate bottleneck-oriented production programmes and transfer the results to operational production planning and control.
In the field of logistics, students understand practice-relevant objects from intralogistics, transport logistics and supply chain management. They can also analyse complex logistical systems.

3 Contents:

- Procurement market research (objects and processes)
- Procurement planning (principles, routes, dates and quantities),
- Procurement execution (supplier selection, requesting and checking of quotes, selection of quotes and ordering),
- Procurement controlling (cost and process control)
- Demand assessment (programme-oriented, consumption-oriented and heuristic demand assessment),
- Inventory planning (inventory types, strategies, management and monitoring),
- Planning of logistics and production processes
- Systematisation of production factors
- Planning and management of production
- Logistics planning
- Logistics systems (intralogistics, transport logistics and storage systems)
- Distribution logistics

4 Forms of teaching:

	Learning materials for self-study, classroom events in the form of exercises	
5	Participation requirements:	
	Formal:	
	Content:	
6	Form of assessment: Term paper or written examination	
7	Condition for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes): Digital Logistics (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: in accordance with BRPO	
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch	
11	Other information:	
12	Language: German	

Databases					**DUD**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3019	150 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	68	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	34	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

Students:

- acquire basic knowledge about the architecture, functioning and use of database systems and know the principles of the organisation of a database system
- acquire knowledge about modern (object-oriented) and classic data modelling including the meaning of normalisation rules
- are able to carry out a complete relational database design, starting from a requirements specification
- are proficient in standard SQL to perform simple and complex queries, as well as change operations.
- gain the ability to evaluate and select database technologies
- can plan and implement database projects and develop a modern database application

3 Contents:

- Introduction to database concepts and database technologies (data modelling, normalisation theory, database language SQL)
- Basics of database systems (database design, database definitions, database queries)
- Data Manipulation Language (DML, German “Datenverarbeitungssprache”), Data Definition Language (DDL, German “Datenbeschreibungssprache”), Data Control Language (DCL, German “Datenaufsichtsprache”)
- Efficiency of SQL queries, index structures
- Authorisation concepts

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Form of assessment:

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

7 Condition for the award of credit points:

Module examination pass and course assessment

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

	Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Dr. rer. nat. Sabrina Proß
11	Other information: -
12	Language: German

Digital B2B Marketing					**DBM**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3362	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH		h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

At the end of the learning process, students are able to:

- Identify and explain the specifics of digital B2B marketing and define key terms;
- Identify key differences from traditional marketing approaches and classify the different methods;
- Discuss digital marketing concepts and compare formats and content, taking into account the particularities of B2B markets;
- Apply basic analytical methods that enable them to compare and evaluate the effectiveness of digital marketing measures;
- Formulate concepts for modern online communication channels against the background of the special circumstances of B2B-influenced products and services, taking into account the legal framework;
- Review the contents of the course independently and to discuss them in learning groups and to present the results obtained.

3 Contents:

- Fundamentals of digital marketing in B2B markets
- Relevance of content marketing
- Planning the online marketing mix
- Digital marketing intelligence
- E-business and e-commerce
- Social media and app marketing
- Legal framework in online B2B marketing

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Form of assessment:

Written exam, project work or oral exam

7 Condition for the award of credit points:

Module examination pass

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

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

9 Importance of the grade for the final grade:

	in accordance with BRPO
10	Module coordinator: Prof. Dr. Adam-Alexander Manowicz
11	Other information: Supplementary literature will be announced before the beginning of the course.
12	Language: German

Digital Technology					**DGT**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3119	150 h	5	2nd or 6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	1	SCH	0	h	32	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	3	SCH	24	h	70	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

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

3 Contents:

Introduction to digital technology
- Terms
- Definitions
- Number systems
- Codes and coding

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

converters Rear
derailleurs
- Bistable and monostable tilting stages
- Delay elements
- Astable tilt steps

Counters
- Asynchronous and synchronous counters
- Design procedures

Programmable Logic Circuits (PLD)
- Introduction of PLDs
- Programming PLDs
- FPGAs
- Hardware description languages

4 Forms of teaching:

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

Documentation of Mechatronic Systems					**DMS**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3126	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	1	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	3	SCH	24	h	54	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

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

3 Contents:

- Fundamentals of machinery safety
- Harmonised European standards
- Conformity and presumption of conformity
- Machinery Directive

- Low Voltage Directive; Product Safety; EMC Directive
- Basics of Product Liability

- ISO 12100 “Safety of machinery”

- Protective devices: separating, non-separating, technical implementation
- Protective distances
- Basics of technical documentation:

- Specifications

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

Introduction to the Professional Field					**EIB**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3000	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	1	SCH	0	h	35	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	2	SCH	32	h	13	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2	Learning outcomes/competences: The students learn about the origin and development of the job description as well as the fields of application of industrial engineers. To this end, they gain an insight into a wide range of business areas relevant to industrial engineers and their professional tasks. They know the basic economic framework conditions of German companies at home and abroad and important company functions. In addition to this basic knowledge, students learn the necessary professional and social skills of engineers in the field of industrial engineering and management and gain a holistic picture of the professional field.
3	Contents: Occupational profile, fields of work and development prospects for engineers in the field of industrial engineering and management: • Basics of industrial enterprises (objectives, structure, types of enterprises, corporate functions) • Tasks of industrial engineers in industrial companies • Basics for analysing relevant industries and markets • Knowledge of project-related working methods • Communication in the company • Management soft skills • Scientific work (presentation, scientific writing) • Excursions to companies with a focus on company processes and areas of activity that are relevant for industrial engineering and management engineers
4	Forms of teaching: Teaching materials for self-study, classroom events in the form of exercises and practicals.
5	Participation requirements: Formal: None Content: None
6	Form of assessment: Term paper, written examination, project work or oral examination
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.

9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Prof. Dr.-Ing. Andrea Kaimann
11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Electrical Machines					**EM**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3124	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

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

3 Contents:

Introduction to drive technology
- Tasks of drive technology
- Basic structure of an electric drive
- Materials for building electric motors
- Cooling of electrical drives
- Losses in electrical drives

Basic electrotechnical laws
- Flow law
- Induction law
- Force action law

DC motor
- Design and operating principle
- Modelling
- Stationary operating behaviour
- Operation on a buck converter
- Inverter circuit
- Pulse width modulation

Synchronous motor
- Design and operating principle
- Modelling
- Stationary operating behaviour and operating point selection

Asynchronous motor
- Design and operating principle

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

Electrical Measurement					**EMT**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3115	150 h	5	3rd or 4th sem.	each semester	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

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

Entrepreneurial Marketing					**EMA**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3361	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to

- Identify and explain the specifics of entrepreneurial marketing and define key terms;
- Classify the contents of entrepreneurial marketing in the context of the knowledge of principles of marketing acquired in other courses and to identify differences;
- Identify the design options of digital customer contact management and compare the different approaches in terms of advantages and disadvantages;
- Apply the methods and concepts of entrepreneurial marketing to selected practice examples and case studies, develop their own solutions and present the results;
- Develop marketing mix concepts with a special focus on innovative products and services;
- Recapitulate the course content independently and enhance their knowledge during self-study. Ideally, they will form learning groups that last throughout the entire seminar.

3 Contents:

- Basics of entrepreneurial marketing
- Opening up customers and markets
- Product innovation and digital branding
- Digital customer experience
- Customer journey management
- Innovative pricing models
- Multi-channel communication

4 Forms of teaching:

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

5 Participation requirements:

Formal:	None
Content:	None

6 Form of assessment:

Written exam, project work or oral exam

7 Condition for the award of credit points:

Module examination pass

8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Prof. Dr. Adam-Alexander Manowicz
11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Accounting and Finance					**ERF**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3010	150 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students understand the structure and content of external accounting.
They understand the system of double-entry bookkeeping, they can represent business transactions in posting records, map the posting records in accounts and develop balance sheet and income statements from the accounts. They can understand the basics of the annual financial statements and the analysis of annual financial statements and illustrate them with practical examples. They understand the importance of financial issues and the relationship between the use of capital and the raising of capital, including its impact on the balance sheet. They will be able to describe the instruments and structuring of capital raising and assess their applicability to practical cases. In addition, they can determine the capital required to ensure liquidity and understand the basics of rating.
Overall, the students can classify the information possibilities of external accounting and classify how operational processes are reflected in the annual financial statements.

3 Contents:

- Fundamentals of Financial Accounting
- Fundamentals of Accounting
- Fundamentals of Financial Statement Analysis
- Determining capital and liquidity requirements
- Instruments of internal and external financing
- Instruments of self-financing and debt financing
- Rating

4 Forms of teaching:

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

5 Participation requirements:

Formal:	None
Content:	None

6 Form of assessment:

Term paper, written examination or oral examination

7 Condition for the award of credit points:

	Module examination pass
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Economist Ulrike Franke
11	Other information:
12	Language: German

Production Engineering					**FET**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3352	150 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

The students can critically evaluate the possibilities and limits of selected manufacturing processes (according to DIN 8580) and check/assess their use for concrete applications (components, workpieces), select suitable processes and design manufacturing solutions:

- They know the basics of industrial manufacturing of workpieces and can explain them.
- They can differentiate main groups of manufacturing processes.
- They have become familiar with selected, practically relevant manufacturing processes and can critically assess their suitability for the production of a specific workpiece/component.
- They will be able to assess the effect of the manufacturing parameters of selected manufacturing processes in terms of quality, costs and environmental impact.

3 Contents:

Today, manufacturing technology is an important tool in the efficient, resource-saving production of innovative, novel products with high utility value. Against this background, students gain a broad overview of the diversity and efficiency of selected, practice-relevant manufacturing processes and technologies. They understand the interrelationship between material/component properties and manufacturing processes with the necessary equipment in order to be able to independently select and apply manufacturing processes according to different product requirements. The professional assessment, selection and use of production technologies is based not only on technical feasibility but also on the economic profitability of production, so that in addition to cost awareness, sensitivity to economic, social and ecological aspects is also heightened.

- Introduction and overview of the manufacturing processes according to DIN 8580
- Primary forming production processes: Casting of semi-finished products, moulding and casting processes, design of castings, sintering
- Forming manufacturing processes: Basics and processes (massive and sheet metal forming), machines for forming technology
- Machining processes: Basics of machining, machining with geometrically defined and undefined cutting edges, machine tools
- Generative manufacturing processes or additive manufacturing: Overview – Process fundamentals – Components and systems – Technology
- Advantages and disadvantages of the processes, process limits and examples of application

	• Overview of process-specific equipment (tools, machines, plants) • Economic feasibility studies
4	Forms of teaching: Lecture notes, seminar-based teaching, practicals, exercises
5	Participation requirements: Formal: None Content: None
6	Form of assessment: Term paper, written examination, project work or oral examination
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with 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

Business Process Modelling and IT Systems					**GPM**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3210	150 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	64	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students:

- structure and evaluate the specific mode of operation of integrated standard software (ERP software).
- design and model processes in the company with the help of modern software architectures (e.g. SOA and BPMS).
- analyse processes and requirements of companies for the use, operation and maintenance of integrated software systems (adaptation options, interfaces to other IT systems, etc.)

3 Contents:

- Process modelling and data modelling using modelling tools such as ARIS
- Evaluation of concepts of integrated data processing
- Drafting reference models for designing the data, process and function models (e.g. Aachen PPS model)
- Analysis of ERP systems (architecture, structuring, database models, HANA)
- Overview of the core modules and applications of ERP systems in the process: e.g. order to cash process)

Application-oriented use cases are used to demonstrate how business processes can be implemented consistently and across software modules.

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Form of assessment:

Term paper, written examination, project work or oral examination

7 Condition for the award of credit points:

Module examination pass and course assessment

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

Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

in accordance with BRPO

10	Module coordinator: Prof. Dr.-Ing. Jörg Nottmeyer
11	Other information: -
12	Language: German

Fundamentals of Electrical Engineering					**GDE**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3003	150 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

Students receive an introduction to the basics of electrical engineering and electronics. This lays the foundation for understanding electrical engineering laws and phenomena, which forms the basis for all fields of electrical engineering.
The students are thus able to solve tasks from the field of electrical engineering and electronics.
Students:

- are able to interpret and analyse direct current circuits.
- can calculate electric and magnetic fields for simple arrangements
- are able to analyse and calculate alternating current circuits
- know simple electronic components in terms of structure and application

3 Contents:

DC technology

- Fundamentals of electrical flow
- Calculation of direct current circuits

Electric and magnetic fields

- The electric field
- The magnetic field

AC technology

- Basic concepts of alternating current technology
- Simple alternating current circuits
- Power in AC circuit
- The calculation of AC circuits
- The transformer

Introduction to electronics

- Electricity conduction in semiconductors, pn junction structure
- Design, functionality and applications of diodes

4 Forms of teaching:

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

5	Participation requirements:	
	Formal:	
	Content:	
6	Form of assessment: Term paper, written examination, project work or oral examination	
7	Condition 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 (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: in accordance with BRPO	
10	Module coordinator: Prof. Dr. Werner Schwerdtfeger	
11	Other information: Supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Basics of Mechanical Design					**GDK**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3120	150 h	5	4th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

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

3 Contents:

General principles of mechanical design:

- Design methodology and systematics
- Technical drawing (types of drawings, structure of technical drawings, representation of components, tolerance specifications in drawings, drawing specifications for technical surfaces)

Introduction to strength of materials:

- Tasks of strength of materials
- External forces and internal stresses
- Basic types of stress
- Temporal load progression
- Strength parameters for material behaviour
- Influences on component strength
- Analytical strength calculation

Selected machine elements and connecting elements:

- Connecting Elements
- Bearing and transmission elements
- Exercises for creating and reading technical drawings as well as for the strength-compliant design of components and for strength verification

4 Forms of teaching:

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

5 Participation requirements:

	Formal:	None
	Content:	None
6	Form of assessment: Term paper, written exam, combination exam, performance exam or oral exam	
7	Condition for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: in accordance with BRPO	
10	Module coordinator: Prof. Dr.-Ing. Klaus Dürkopp	
11	Other information: Supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Basics of Programming					**GDP**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3104	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	64	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students:

- are proficient in using the terminology of computer science.
- obtain basic knowledge of the functioning of computer systems and can apply it.
- gain the ability to structure simple information technology problems and to convert them into solution modules.
- are enabled to solve simple problems independently in a programming language.
- gain basic knowledge in the application and implementation of simple algorithms.
- acquire basic competences for the analysis of problems and the structured transfer into simple procedural and modularised system solutions.

3 Contents:

- Basic concepts
- Basic structure of computer systems and peripheral devices, functioning of computer systems
- Basic representation of data in computer systems, Boolean algebra
- Use of development environments
- Introduction to a programming language
- General structure of programmes
- Variable types, structures
- Functions for input and output
- Control structures
- Functions
- Vectors and pointers
- Recursion / iteration, modular programming
- Algorithms and data structures: Sorting algorithms, Q-Sort, Bubbel-Sort, etc.

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Form of assessment:

Term paper, written examination, project work or oral examination

7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Digital Logistics (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch
11	Other information: -
12	Language: German

Fundamentals of Economic Sciences					**GWW**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
6121	150 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2	Learning outcomes/competences: The students can classify and present the interplay of market and price and their significance for economic systems. They have basic knowledge of essential issues of business administration and can apply this to business practice. They can recognise and assess the overall interrelationships between goods, services and finance. In this way, they understand the fundamental interrelationships of the individual sub-areas of business administration. Thus, students are able to think in business terms. Students have the basic understanding to attend the modules “Accounting, Investment, Financing and Taxes,” “Personnel and Organisation,” “Business Process Modelling and IT Systems,” “Procurement, Production and Logistics,” “Digital Service Engineering and Services Marketing,” “Accounting and Finance,” “Cost and Investment Accounting,” “Controlling,” “Marketing and Sales,” “Business Law,” “Lean Production.”
3	Contents: • Corporate functions • Economic fundamentals of the market and competition • Significance of the enterprise in the social market economy • Enterprises as a subject of business administration • Enterprise objectives • Legal forms of companies/combinations of companies • Marketing basics
4	Forms of teaching: Learning materials for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: Content:
6	Form of assessment: Term paper, written examination, project work or oral examination
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Digital Logistics (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.

9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Economist Ulrike Franke
11	Other information:
12	Language: German

Semiconductor Devices and Circuits					**HBS**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3255	150 h	5	3rd or 5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

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

3 Contents:

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

Bipolar transistors
- Types:

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

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

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

Optoelectronic components

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

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

Industrial Communication					**IKK**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3127	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

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

3 Contents:

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

Industrially used examples of layers 1 and 2:
• Synchronous and asynchronous BUS technologies
• Real-time communication capability
• Requirement of real-time systems
• Measures for the realisation of real-time
• Structure and usability of the Ethernet protocol
• Industrial fieldbuses: with own protocol
o AS-Interface, CAN, CANOpen; Profibus, HART, ...
o Measures for explosion protection
• Ethernet-based fieldbuses: EtherCAT, ProfiNet, ..
• Bus technologies with single master; multi-master and masterless buses

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

Industrial Control Technology					**IST**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3117	150 h	5	4th or 6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	1.5	SCH	24	h	0	h

2 Learning outcomes/competences:

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

3 Contents:

Introduction to control technology
- Terms
- Definitions

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

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

Design and structures of industrial controls
- PLC and PC-based control
- Information processing

Structured programming according to IEC 61131
- Graphics- and text-based programming languages
- Basics of object-oriented PLC programming

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

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

Innovation and Project Management					**IPM**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3211	150h	5	3rd/4th/5th/ 7th sem.	each semester	1 semester

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

2 Learning outcomes/competences:

Students:

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

3 Contents:

- Basics of project management (terms/methods/instruments)
- Project phase models and planning systems (project preparation, project planning, project implementation, project completion)
- Agile project management
- Project organisation forms
- Innovation and change management, self-management
- Project planning (project structure plan/cost plan/resource plan/schedule)
- Project documentation/project controlling
- Risk management

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

Cost and Investment Accounting					**IRI**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3015	150 h	5	4th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact hours/face-to-face teaching:		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	62	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

Students are familiar with entrepreneurial and networked thinking, including a profitability-oriented assessment in all entrepreneurial activities and decision-making areas.
They assess the advantageousness of individual investment measures, make a selection between competing investment projects and evaluate how long investments are to be utilised.
They use cost accounting as a decision-support tool.
They have a basic understanding of cost accounting and know basic standards and terms of cost accounting. They are able to critically assess and evaluate practical applications of cost accounting methods.

3 Contents:

- Fundamentals of financial mathematics
- Fundamentals of business investment decisions
- Static investment calculation methods
- Dynamic investment calculation methods
- Cost type, cost centre, cost unit accounting
- Standard cost accounting
- Planned costing
- Contribution margin accounting
- Target costing
- Fundamentals of production and cost theory
- Activity-based costing
- Short-term income statement on full and partial cost basis

4 Forms of teaching:

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

5 Participation requirements:

Formal:	None
Content:	None

6 Form of assessment:

Term paper, written examination or oral examination

7 Condition for the award of credit points:

	Module examination pass
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Economist Ulrike Franke
11	Other information:
12	Language: German

Colloquium					**KOL**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3134	90 h	3	7th sem.	Annual (Summer)	1 semester

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

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

Lean Production					**LPM**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3215	150 h	5	4th or 6th sem.	Annual (Summer)	1 semester

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

2 Learning outcomes/competences:

Students:

- can independently apply selected lean methods from the areas of production, administration and development.
- can document production processes in a structured manner and identify potential for improvement in the process flow as well as derive measures for optimisation.
- can implement the methods of “leadership on the ground” and establish constructive cooperation in a team of production workers.

3 Contents:

- Vision of a Lean Company
- Problem-solving techniques and strategies
- Effects of Lean Management methods
- Value stream mapping / value stream design (theory and concrete examples)
- Production systems using the example of the Toyota Production System
- Muda (types of waste and their avoidance)
- Jidoka principle (quality in process – Andon, Poka Yoke)
- Just-in-time principle (Kanban, levelling)
- One-piece production in flow principle (One-Piece Flow)
- Set-up time reduction (SMED “Single Minute Exchange of Die”)
- Employee participation and responsibility
- Process standardisation and improvement work (Kaizen)
- Planning, steering and communicating successful change processes

4 Forms of teaching:

Study units for self-study, face-to-face teaching in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Form of assessment:

Term paper, written examination, project work or oral examination

7 Condition for the award of credit points:

Module examination pass

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

Digital Logistics (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.

9 Importance of the grade for the final grade:

	in accordance with BRPO
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch
11	Other information: -
12	Language: German

Power Electronics					**LE**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3123	150 h	5	5th sem.	Annual (Winter)	1 semester

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

2 Learning outcomes/competences:

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

3 Contents:

General Aspects
Switching of ohmic-inductive loads
Introduction to power semiconductors

Thermal conductivity model

Switching behaviour of power semiconductors

Power converter circuits
Single-pulse rectifier
Multi-pulse rectifier
Boost/buck converter
H-Bridge inverter
Three-phase inverters
Inverter circuit
Harmonics and power

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

4 Forms of teaching:

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

5 Participation requirements:

Formal:	None
Content:	None

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

Marketing and Technical Sales					**MUV**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3355	150 h	5	4th or 6th sem.	Annual (Summer)	1 semester

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

2 Learning outcomes/competences:

Upon completion of the learning process, the successful student will be able to:

- Identify and explain the specifics of business-to-business (B2B) marketing and the core content of technical sales;
- Describe and define the concepts relevant to the B2B business;
- On the basis of acquired analysis and planning skills, to reflect critically on current market developments against the background of increasing digitalisation and internationalisation;
- Apply the design options of the marketing mix to selected practice examples and case studies, compare them and decide which method to use;
- Discuss in learning groups questions about structures and concepts in the sales of technical products, develop your own solutions and present the results.

3 Contents:

- Business-to-business marketing basics
- Buyer behaviour in business markets
- Market research and market segmentation
- Product policy in the individual product life cycle phases
- Instruments and strategies of price and communication policy
- Classic forms of sales and online sales
- Establishing and controlling a sales organisation
- Aspects of the marketing mix with focus on digitalisation

4 Forms of teaching:

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

5 Participation requirements:

Formal:	Formal:
Content:	Content:

6 Form of assessment:

Written exam, project work or oral exam

7 Condition for the award of credit points:

Module examination pass

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

Digital Technologies (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.

9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Prof. Dr. Adam-Alexander Manowicz
11	Other information: Literature will be announced before the start of the course.
12	Language: German

Mathematics I					**MATH1**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3218	150 h	5	1st sem.	Annual (Winter)	1 semester

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

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

12	Language: German

Mathematics II					**MATH2**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3257	150 h	5	2nd sem.	Annual (Summer)	1 semester

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

2	Learning outcomes/competences: Students: • can deepen their knowledge in the area of calculus. • master the essential principles of integral calculus and differential calculus for functions of several variables. • have an overview of the methods for the analytical solution of ordinary differential equations and systems of differential equations and can apply these to practice-oriented problems.
3	Contents: • Complex numbers (definition and representation, complex calculus) • Integral calculus for functions of one variable (fundamental theorem of differential and integral calculus, integration rules, integration methods, improper integrals, applications) • Differential calculus for functions of several variables (functions of several variables, partial differentiation) • Ordinary differential equations (differential equations of the 1st order, linear differential equations of the 2nd or nth order with constant coefficients, systems of linear differential equations)
4	Forms of teaching: Study units for self-study, face-to-face teaching in the form of exercises
5	Participation requirements: Formal: - Content: - Modules: 3218 Mathematics I;
6	Form of assessment: Written examination, combination exam, oral exam or exam accompanying the course
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator:

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

Measuring Systems and Sensors					**MUS**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3128	150 h	5	6th sem.	Annual (Summer)	1 semester

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

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

Methodical Design and CAD					**MKC**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3354	150 h	5	5th sem.	Annual (Winter)	1 semester

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

2 Learning outcomes/competences:

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

With regard to CAD, students are able to:

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

3 Contents:

Methodical construction:

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

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

Practical training on a CAD system

4 Forms of teaching:

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

5 Participation requirements:

Formal:

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

Microcontroller Programming					**MCP**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3220	150 h	5	6th sem.	Annual (Summer)	1 semester

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

2	Learning outcomes/competences: Students: • learn the basics of embedded systems based on microcontrollers and single-board computers. • get hands-on experience in designing hardware-based microcontroller product architectures and cloud solutions, low-power M2M communication as well as sensor networks. • are capable of implementing their own small hardware projects. • can evaluate and make judgements about systems or products based on embedded systems. • can translate customer requirements into viable technical concepts and product architectures, taking into account efficiency and modularity.
3	Contents: • Basics Embedded Systems ‘Internet of Things’ (IoT) • Network technologies (Ethernet, Wifi, Bluetooth, etc.). • Identification technology (barcode scanners, RFID systems) • Concepts and aids (tools) of embedded systems and IoT • Embedded systems platforms (e.g. Arduino/Energia, Raspberry PI, ARM microcontrollers, etc.) • Communication via bus systems (e.g. I2C, SPI, UART) • Reading out sensors • Special components (A/D converter, D/A converter) • Integration into overall systems
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals
5	Participation requirements: Formal: - Content: -
6	Form of assessment: Term paper, written examination, project work or oral examination
7	Condition for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes):

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

Personnel and Organisation					**PUO**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3011	150 h	5	7th sem.	Annual (Winter)	1 semester

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

2 Learning outcomes/competences:

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

3 Contents:

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

4 Forms of teaching:

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

5 Participation requirements:

Formal:	None
Content:	None

6	Form of assessment: Term paper, written exam, performance exam, project work or oral exam
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Digital Logistics (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Economist Ulrike Franke
11	Other information:
12	Language: German

Physics					**PH**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3101	150 h	5	1st sem.	Annual (Winter)	1 semester

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

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

9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: - tba
11	Other information: Supplementary literature will be announced at the beginning of the course.
12	Language: German

Controlling					**PUC**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3017	150 h	5	5th sem.	Annual (Winter)	1 semester

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

2	Learning outcomes/competences: Students are familiar with the basics of planning and strategic management. They are familiar with different schools of thought of strategic management, corresponding strategy approaches (e.g. resource-based view) and management concepts (e.g. knowledge/innovation management) and can apply them. In addition, the students can use operative, tactical and strategic planning instruments as well as instruments from controlling (e.g. balanced scorecard). By carrying out a company simulation, the students are enabled to carry out independent control processes in companies and also to use this knowledge in the context of international cooperation.
3	Contents: • Fundamentals of planning and strategic management • Schools of thought in strategic management • Strategic approaches • Management concepts • Operational, tactical and strategic planning tools • Operational controlling tools • International/intercultural perspectives
4	Forms of teaching: Lecture notes, seminar-based teaching, exercises, business simulation
5	Participation requirements: Formal: None Content: Accounting and Finance Cost and Investment Accounting Fundamentals of Economic Sciences
6	Form of assessment: Term paper, written examination, project work or oral examination
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator:

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

Practical Module I					**PX1**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3112	150 h	5	3rd sem.	Annual (Winter)	1 semester

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

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

Practical Module II					**PX2**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3122	150 h	5	5th sem.	Annual (Winter)	1 semester

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

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

Practical Module III					**PX3**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3129	150 h	5	6th sem.	Annual (Summer)	1 semester

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

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

Quality Management					**QMG**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3201	150 h	5	4th or 6th sem.	Annual (Summer)	1 semester

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

2	Learning outcomes/competences: Students: • can determine/assess the “value” (cost/benefit) of quality for a company and can understand the development of quality management. • understand and distinguish between the existing quality management models and can apply quality management systems in a purposeful manner. • can integrate quality management into existing management structures of a company.
3	Contents: • The term ‘quality’ • Basics of quality management systems (QMS), tasks and objectives of QMS in the company • Terms and definitions in quality management • Analysis of the costs/benefits of a QM system • Strategies for increasing and ensuring ‘quality’ in the company (PDCA cycle) • Tools, procedures, means, processes of quality planning, control, inspection and improvement Prerequisites for the successful use of management systems for quality management in the company Overarching aspects of quality management: Standardisation, certification etc.
4	Forms of teaching: Study units for self-study, face-to-face teaching in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Form of assessment: Term paper, written examination, project work or oral examination
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Digital Logistics (work-integrated) B.Eng., Product-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade:

	in accordance with BRPO
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch
11	Other information: -
12	Language: German

Feedback Control Engineering					**RTK**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3125	150 h	5	4th/5th/6th sem.	each semester	1 semester

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

2 Learning outcomes/competences:

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

3 Contents:

Introduction to Control Engineering
- Terms
- Definitions
- Block diagrams

Transmission link analysis
- Steady-state and dynamic behaviour
- Frequency response and floor diagram
- Determining mathematical models for technical systems

The control loop
- Basic structure of the control loop
- Control loop structures
- Stability behaviour of control loops
- Classical linear controllers
- Simple design procedures
- Parameter-optimal controls

4 Forms of teaching:

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

5 Participation requirements:

Formal:	
Content:	

6 Form of assessment:

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

Statistics					**STAT**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3224	150 h	5	3rd or 4th sem.	each semester	1 semester

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

2	Learning outcomes/competences: Students: • can explain basic concepts of statistics. • can apply the basic methods and procedures of descriptive statistics and probability theory. • are able to analyse economic questions and problems with statistical methods and to show correlations. • are able to solve tasks with the help of suitable software (SPSS, Excel,...).
3	Contents: • Descriptive statistics (one-dimensional frequency distributions, measures, multivariate statistics, regression analysis) • Probability theory (discrete and continuous distributions) • Statistical inference • Use of Excel/SPSS
4	Forms of teaching: Study units for self-study, face-to-face teaching in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Form of assessment: Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course
7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Digital Logistics (work-integrated) B.Eng., Digital Technologies (work-integrated) B.Eng., Mechatronics/Automation (work-integrated) B.Eng., Pro-duct-Service Engineering (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Dr. rer. nat. Sabrina Proß
11	Other information: -
12	Language: German

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

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

2	Learning outcomes/competences:	
	The students know and understand the basic relationships of statics as the study of the balance of forces in and on mechanical structures at rest and can apply these independently to simple examples from practice. Furthermore, they know the basic relationships between the external loads and the resulting internal stresses and deformations, so that they can carry out strength verifications for simple statically stressed components using relevant material parameters.	
3	Contents:	
	Basic concepts of mechanics: • Force – Balance – Rigid Body • Statics: Introduction – Plane system of forces – Centre of gravity – Static equilibrium of bodies – Freeing – Determination of support and intermediate reactions – Friction • Strength of materials: Introduction to strength theory – Internal forces – Tensile or pressure load – Shear – Bending load – Torsional stress – Buckling stress – Composite stress	
4	Forms of teaching:	
	Learning units for self-study, classroom events in the form of exercises and practicals	
5	Participation requirements:	
	Formal:	None
	Content:	None
6	Form of assessment:	
	Written examination, combination examination or oral examination	
7	Condition for the award of credit points:	
	Module examination pass and course assessment	
8	Application of the module (in the following study programmes):	
	Mechatronics/Automation (work-integrated) B.Eng. and Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade:	
	in accordance with BRPO	
10	Module coordinator:	
	Prof. Dr.-Ing. Andrea Kaimann	

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

Technical English					**TCE**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3121	150 h	5	1st, 3rd or 5th sem.	Annual (Winter)	1 semester

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

2 Learning outcomes/competences:

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

3 Contents:

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

4 Forms of teaching:

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

5 Participation requirements:

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

6 Form of assessment:

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

Process Engineering					**VET**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3013	150 h	5	6th sem.	Annual (Summer)	1 semester

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

2 Learning outcomes/competences:

Instrumental competence:
Application of the acquired basic knowledge on the example of simple process engineering equipment and machines with regard to thermodynamics and fluid mechanics

Systematic competence:
Independent recognition of the interrelationships, introduced by comprehension of the process engineering processes carried out (mixing, separating, heat exchanger).
The technical issues that arise should be reliably recognised, described, evaluated and solved.
To derive scientifically sound judgements about the mode of action from this, to substantiate them in further new applications, to recognise interface problems

Communicative competence:
Work on tasks in interdisciplinary teamwork.

3 Contents:

1. Introduction to process engineering
   - Development of process engineering – The process engineering process – Balancing – Economic consideration
2. Mechanical process engineering: Fluid mechanics and stirring technology
   - Fluid mechanics basics – Pumps and compressors – Stirring technology
3. Mechanical process engineering: Disperse systems and mechanical processes – Disperse systems – Shredders and classifiers – Grain enlargement – Substance separation
4. Thermal process engineering
   - Energy balance – Heat and mass transfer – Thermal separation processes

Exercise: Calculation tasks for the above-mentioned areas of process engineering using practical examples. Working out the solutions in small groups

4 Forms of teaching:

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

5	Participation requirements:	
	Formal:	None
	Content:	None
6	Form of assessment: Term paper, written examination, project work or oral examination	
7	Condition for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.	
9	Importance of the grade for the final grade: in accordance with BRPO	
10	Module coordinator: Prof. Dr.-Ing. Jürgen Hermeler	
11	Other information: Supplementary literature will be announced at the beginning of the course.	
12	Language: German	

Elective Module Industrial Engineering and Management (work-integrated)					**WM**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
9009	150 h	5	5th or 6th sem.	each semester	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students		SCH		h		h
	Seminar tuition	30 students		SCH		h		h
	Exercise	20 students		SCH		h		h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students		SCH		h		h
2	Learning outcomes/competences:							
3	Contents:							
4	Forms of teaching:							
5	Participation requirements:							
	Formal:							
	Content:							
6	Form of assessment:							
7	Condition for the award of credit points:							
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.							
9	Importance of the grade for the final grade:							
10	Module coordinator: Prof. Dr.-Ing. Andrea Kaimann							
11	Other information:							
12	Language: German							

Materials Engineering					**WT WIG**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3007	150 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes:	Volume:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	56	h
	Seminar tuition	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	46	h
	Practical or seminar	15 students	1	SCH	16	h	8	h
	Supervised self-study	60 students	1	SCH	16	h	0	h

2 Learning outcomes/competences:

The students understand the relationships between the structure of mechanical materials and their properties by

- acquiring knowledge about the microstructural composition and its modification by alloying elements,
- understanding the deformation behaviour as well as the transformation behaviour and phase reactions,
- developing skills to apply material parameters to different set conditions and to transfer these to the component design
- acquiring competences to measure and assess material properties within the framework of a material test and to bring about changes in material behaviour in a targeted manner through heat treatments or mechanical deformation.

3 Contents:

- Structure of metallic materials,
- Lattice defects and their effect on material behaviour
- Deformation and fracture: strength, toughness, ductility
- Alloying: state diagrams and iron-carbon diagrams,
- time-temperature transformation and austenitisation
- Influence of selected alloying elements
- Hardening & tempering
- Steel designations
- Properties and material behaviour of selected steel materials such as structural steels, case-hardened and tool steels, cast iron.

Selected areas of material testing and material properties are enhanced in practicals.

4 Forms of teaching:

Assignments for self-study, practicals, exercises, supervised self-study

5 Participation requirements:

Formal:	None
Content:	None

6 Form of assessment:

Written examination or oral examination

7 Condition for the award of credit points:

Module examination pass

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

	Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with BRPO
10	Module coordinator: Prof. Dr.-Ing. Thomas Kordisch
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Business Law					**WR**
ID:	Workload:	Credits:	Study semester:	Frequency:	Duration:
3026	150 h	5	7th sem.	Annual (Winter)	1 semester

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

2 Learning outcomes/competences:

The students ...

- know the principles of legal thinking and working methods.
- know the basics of German contract, commercial, corporate and employment law and understand the importance of legal structuring for the most important operational areas.
- can appropriately consider legal aspects in the context of their own decisions.
- can assess which persons can conclude contracts, how contracts are concluded and how their content is determined.
- can decide how contractual clauses can be effectively included in a contract and assess the permissibility of the clauses.
- understand how the choice of the legal form of a company affects business practice, especially in questions of representation and liability.
- know the legal basis of personnel selection in labour law, the special duties of the employer and the employees as well as the possibilities of terminating the employment relationship.
- can apply the fundamentals they have learned to simple issues themselves and make well-founded decisions.

3 Contents:

- Basic principles of contract law (conclusion and execution of contracts, general terms and conditions, liability, purchase contract and contract for work and services)
- Basic features of commercial and company law (prerequisites and consequences of being a merchant, choice of legal form, representation, liability)
- Principles of employment law
- Exercises through case studies and application examples from the business sector

4 Forms of teaching:

Lecture notes, seminar-based teaching, exercises

5 Participation requirements:

Formal:	None
Content:	None

6 Form of assessment:

Term paper, written examination, project work or oral examination

7	Condition for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes): Industrial Engineering and Management (work-integrated) B.Eng.
9	Importance of the grade for the final grade: in accordance with 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