Appendix A

Course schedule for the part-time combined study programme Mechanical Engineering

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

First semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Technical Documentation	5	4	2	-	1	1	24
Mathematics I	5	4	2	-	2	-	16
Engineering Mechanics I	5	4	2	-	2	-	16
Fundamentals of Industrial Computer Science	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**
Second semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Physics	5	4	2	-	1	1	24
Mathematics II	5	4	2	-	2	-	16
Engineering Mechanics II	5	4	2	-	2	-	16
CAD	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**
Third semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Mathematics III	5	4	2	-	2	-	16
Engineering Mechanics III	5	4	2	-	2	-	16
Construction Elements I	5	4	2	-	1	1	24
Fundamentals of Electrical Engineering	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**
Fourth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Construction Elements II	5	4	2	-	2	-	16
Plastics Engineering	5	4	2	-	1	1	24
Industrial Management	5	4	2	-	2	-	16
Metal Engineering	5	4	2	-	1	1	24
Totals	**20**	**16**	8	-	**6**	**2**	**80**
Fifth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Elective Project	5	4	2	-	2	-	16
Lightweight Materials	5	4	2	-	2	-	16
Thermodynamics	5	4	2	-	1	1	24
Production Engineering I	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**
Sixth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Industrial Control Technology	5	4	2	-	1	1	24
Fluid Mechanics and Flow Machines	5	4	2	-	2	-	16
Technical English	5	4	2	-	2	-	16
Production Engineering II	5	4	2	-	2	-	16
Totals	**20**	**16**	**8**	**-**	**7**	**1**	**72**

Seventh semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Fundamentals of Mechanical Process Engineering	5	4	2	-	2	-	16
Measurement and Control Technology	5	4	2	-	1	1	24
Compulsory Elective Module I	5	4	2	-	*	*	*
Compulsory Elective Module II	5	4	2	-	*	*	*
Totals	**20**	**16**					
Eighth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Calculation and Simulation Technology in Industrial Production	5	4	2	-	2	-	16
Project Management	5	4	2	-	2	-	16
Compulsory Elective Module III	5	4	2	-	1	1	24
Compulsory Elective Module IV	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**
Ninth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Quality Management	5	4	2	-	1	1	24
Bachelor Thesis	12	-	-	-	-	-	-
Colloquium	3	-	-	-	-	-	-
Totals	**20**	**4**	**2**	**-**	**1**	**1**	**24**

Legend:

L	= 100% study materials	+ 0% classroom teaching
ST and E	= 50% study materials	+ 50% classroom teaching
P	= 0% study materials	+ 100% classroom teaching

* The extent of classroom teaching can be found in the respective compulsory elective modules.

Focus: Further Education	ECTS	SCH	L	ST	E	P	Classroom teaching
CEM I: Diagnosis and Support	5	4	2	-	1	1	24
CEM II: Vocational Education I and Vocational Field Practical	5	4	-	-	2	-	16
CEM III: Didactics of Technology	5	4	2	-	1	1	24
CEM IV: Vocational Education II	5	4	2	-	1	1	24
Totals	**20**	**16**	**6**	**-**	**5**	**3**	**88**

Focus: Production Technology	ECTS	SCH	L	ST	E	P	Classroom teaching
CEM I: Production Management and Factory Organisation	5	4	2	-	2	-	16
CEM II: Production Automation and Digitalisation	5	4	2	-	2	-	16
CEM III: Plastics Production Process	5	4	2	-	1	1	24
CEM IV: Rapid Prototyping / Additive Manufacturing	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**

Focus: Product Development	ECTS	SCH	L	ST	E	P	Classroom teaching
CEM I: Product Risk Management	5	4	2	-	2	-	16
CEM II: Innovation Techniques	5	4	2	-	1	1	24
CEM III: Designing with Plastics	5	4	2	-	1	1	24
CEM IV: Rapid Prototyping / Additive Manufacturing	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**5**	**3**	**88**

Additional module for the focus on further education: General Didactics and Orientation Practical

Legend:

L	= 100% study materials	+ 0% classroom teaching
ST and E	= 50% study materials	+ 50% classroom teaching
P	= 0% study materials	+ 100% classroom teaching

Appendix B

Module catalogue

for the bachelor's degree study programme in
Mechanical Engineering (part-time combined studies)
of the Faculty of Engineering and Mathematics

As of: 27 July 17

Table of contents

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

General Didactics and Orientation Practical					ADOP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4078	125 h	5	Add-on module	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	3	h
	Practical or seminar	15 students	0	SCH	106	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students

- understand didactics as a sub-discipline of pedagogy and are able to draw further boundaries to neighbouring disciplines and related disciplines as well as to identify subject areas and functions of didactics.
- are able to distinguish between selected didactic theories and models and to highlight the significance of these theoretical foundations for the planning of teaching-learning processes.
- have a basic knowledge and understanding of teaching categories, can apply them in initial planning attempts and critically evaluate them.
- are able to transfer the steps of lesson planning and to use them for their own teaching encounter in the orientation practical internship.
- are able to critically question this knowledge, to modify resulting questions in exploratory questions and to systematically elaborate them during the orientation practical internship.
- reflect on their own developmental process and include both initial practical work experience and theoretical discussions about a variety of exploration topics.

3 Contents:

Genesis, subject areas/tasks, research approaches in didactics, didactic theories, e.g. didactics of educational theory, critical-constructive didactics, didactics of learning/teaching theory,
Basic forms of didactic lesson planning, implementation and analysis,
Target groups of didactic action.

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Thorsten Jungmann

11 Other information:

	-

Bachelor Thesis					BA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1291	300 h	12	9th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	300	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	After successfully completing the bachelor thesis, students are able to independently work on and 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	Forms of assessment:	
	Bachelor thesis	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);	
9	Importance of the grade for the final grade:	
	Percentage based on the sum of credits of the graded modules according to RPO- BA §32	
10	Module Officer:	
	Prof. Dr.-Ing. Michael Fahrig	
11	Other information:	
	-	

Calculation and Simulation Technology in Industrial Production					BUST
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4075	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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:

The students can..

- apply different simulation technologies and tools.
- transfer the modern methods and procedures of simulation in the context of industrial production to their areas of application.
- assess the possible applications of simulations in industrial production in order to use them sensibly.
- carry out a simulation study with appropriate simulation tools, work on complex problems and develop their own approaches for simulation applications in industrial production.
- apply the acquired interdisciplinary methodological competences situationally in practice
- apply knowledge and skills to concrete and new tasks.

3 Contents:

Simulation basics
Simulation as a key technology for the future – application examples of today's possible uses, highlighting limits and problems
Simulation in automation technology – requirements and possibilities
Digital factory
Graphic 3D simulation
Simulation technologies and characterisation of simulators available on the market; procedure for a simulation study
Problem definition, data collection, model building, as well as its implementation, verification and validation
Process management (optimisation of business processes with the help of simulation)
Offline programming and virtual commissioning
Basics and performance characteristics of graphical 3D simulation systems in industrial use
Agent control & optimisation strategies virtual commissioning
Practical application of simulation tools
In several exercises, students can gain experience with the available simulation tools in the areas of material flow, logistics, assembly and robotics as well as in the area of virtual commissioning.

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination, oral examination, term paper, project work, presentation

7 Prerequisite for the award of credit points:

Module examination pass

8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.)
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Jürgen Sauser
11	Other information: -

Vocational Education I and Vocational Field Practical					BPD1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4046	125 h	5	7th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	29	h
	Practical or seminar	15 students	0	SCH	80	h	0	h
	Supervised self study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students:

- understand vocational education as a sub-discipline of educational science, are able to distinguish the respective subject areas and research fields from each other and explain them in context.
- systematically reflect on exemplary practical experiences in the workplace and also examine motives for their own career choice.
- are able to identify requirements for company and school educators and in this context understand vocational education as a profession.
- can describe the structures and forms of the vocational education system in Germany and consider the historical, educational and legal framework.

3 Contents:

- Concepts, subject areas and research fields of educational science and vocational education as a sub-discipline of educational science,
- Objectives, structures and systems of the (Vocational) Educational Training (VET) system, legal framework of VET
- Contributors and roles in the VET system
- Processes of (vocational) pedagogical professionalisation

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Thorsten Jungmann

11 Other information:

-

Vocational Education II					BPD2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4048	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students:

- can critically reflect and classify current research trends in Vocational Educational Training (VET) research on the basis of their level of knowledge. In this context, they discover possible research desiderata in their own profession-specific field,
- recognise interfaces to general and subject-related didactics in the context of VET research and empirical teaching research.
- are able to derive vocational education issues or problems and to deal with them in a systematically and theoretically sound manner, taking into account existing criteria of scientific work,
- are able to describe the process of developing a teaching-learning scenario,
- based on the framework curriculum of an apprenticeship occupation, interpret the learning field in an exemplary way and transform it didactically.

3 Contents:

- Principles of academic papers
- Research objects, research questions and research methods in education and training research,
- Concept of practice or action research to explore own teaching, learning field and competence-oriented design of teaching,
- Action orientation

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Term paper, course assessment

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Thorsten Jungmann

11 Other information:

-

CAD					CA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4008	125 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students are able to:

- describe the functions and possibilities of common 3D CAD systems.
- create and manipulate 3D models.
- create 3D assemblies.
- derive 2D drawings from 3D models.

3 Contents:

The students get to know and apply systems and working techniques of computer-aided construction.
CAD systems:
Definition and historical development, reasons for introduction and distribution, equipment technology, programmes for CAD, data exchange
CAD working techniques:
Input techniques, coordinate systems, operators and operands, construction methods for 2D geometry, 3D geometry models (corner, edge, surface, volume models), methods for structuring CAD data, variant construction through parameterisation, solid modelling through solid element synthesis, solid modelling through rotation and extrusion, levels of detail for 3D CAD models, application extensions
Practical on an integrated CAE system (Solid Edge, NX) with interface and data consideration for other CAE processes such as FEM, CAD/CAM, 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 Forms of assessment:

Combination exam

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Herbert Funke

11 Other information:

-

Diagnosis and Support					DF
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4045	125 h	5	7th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students

- have a basic knowledge and understanding of the construct of diagnostic competence in the context of pedagogical action and can assess and/or deduce the significance of diagnostic competence, also taking into account empirical findings.
- know teaching features relevant to learning and can reflect on their significance against the background of their own learning biographical experiences. In this context, they reflect on and/or identify possible objects of exploration for teaching in the context of the orientation practical internship and develop a first basic understanding of research-based learning as a concept of higher education didactics.
- differentiate selected learning theories from each other and are additionally able to point out application references from the different theories in a well-founded way. In the process, they develop their own initial understanding of learning.
- are able to show the importance of competence orientation for the vocational education system and to assess its consequences, especially for the design of competence-oriented examinations.
- have a critical understanding of the aspects of individuality and heterogeneity in learning groups and, in this context, have basic knowledge of individual support for learners and their learning processes.

3 Contents:

- Basics of diagnostic competence of teachers in the context of pedagogical professionalisation,
- Research methodological principles of observation, observation and assessment tools,
- Observation and assessment errors, professional teaching perception, learning theories,
- Competence orientation, competence-oriented examinations,
- Individuality and heterogeneity in learning groups, individual support

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written or oral examination, course assessment

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

	Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Thorsten Jungmann
11	Other information: -

Production Engineering I					FT1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4020	125 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful attendance of the course, the students are able to

- compare the basics of industrial manufacturing of workpieces
- differentiate the main groups of manufacturing processes
- the important manufacturing processes of the main groups forming, shaping, cutting, implement joining and coating
- evaluate the effect of the manufacturing parameters of these selected manufacturing processes on quality and costs
- evaluate the application of these procedures
- carry out simple calculations for the most important manufacturing processes

3 Contents:

Students gain a broad overview of the variety and efficiency of the most diverse manufacturing processes. They understand the interrelationship between material/component properties and manufacturing processes with the necessary equipment (machines) in order to be able to select and apply the manufacturing processes according to different product requirements. The professional assessment, selection and use of production technologies is of course not only based on technical feasibility but also on the economic efficiency of production, whereby, in addition to cost awareness, sensitivity to economic, social and ecological aspects is also sharpened.

1. Introduction and overview of the manufacturing processes
2. Primary forming manufacturing processes
- Overview - Casting of semi-finished products - Moulding and casting processes - Design of castings - Sintering processes
3. Generative manufacturing processes
- Overview - Process fundamentals - Components and systems - Technology
4. Forming manufacturing processes
- Basics and methods of forming - Solid forming - Sheet metal forming
5. Separating manufacturing processes
- Overview - Cutting - Machining - Removal
6. Joining manufacturing processes
- Overview - Mechanical Joining - Welding - Bonding - Soldering
7. Coating manufacturing processes
- Overview - Coating from the liquid / plastic / pulverulent / gaseous / ionised state

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Magnus Horstmann
11	Other information: -

Production Engineering II					FT2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4024	125 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 this module, students will be able to

- differentiate in detail the applications of important industrial manufacturing processes for the production of metalworking workpieces
- evaluate typical machines and tools for the selected manufacturing processes
- evaluate the effect of manufacturing parameters on quality and costs, plan suitable processes from them
- carry out calculation methods for the most important manufacturing processes
- be able to assess the essential tasks in planning and controlling production

3 Contents:

The students gain an in-depth insight into individual manufacturing technology processes, in particular forming technology and machining manufacturing processes. Current trends in research and development will be addressed. To understand the influence of the equipment used, machine types and application areas of machine tools are presented. The necessary degree of automation is explained in relation to the requirements for productivity and flexibility using practical examples (flexible production cells, machining centres, etc.).
In addition, students are taught basic knowledge for solving the diverse planning tasks in production, especially in a production planning.

1. Machine tools for manufacturing
- Overview - Structure - Requirements
2. Advanced Forming Manufacturing Processes
- Calculation methods - machine/plant technology
3. Specialisation in machining processes
- Calculation methods - machine/plant technology
4. Production planning and control
- Work preparation - Production planning - Production equipment planning - Inspection planning
- Investment planning - Method planning - Production control

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

	Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Magnus Horstmann
11	Other information: -

Plastics Production Process					FVK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4032	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students:

- are able to assess the essential processes of plastics processing in a practice-orientated manner and to use them in an application-orientated manner.
- know the essential design criteria for tools used in plastics processing, especially for injection moulds.

3 Contents:

Students are taught overviews of the essential manufacturing techniques for the production of semi-finished and finished plastic parts as well as the tools for essential plastics processing methods injection moulding tools are covered in depth.
Plastics Chemistry
Properties of the plastics: Thermal, electrical, mechanical, chemical, optical, acoustic properties, shrinkage and warpage, relaxation and retardation
Plastics processing and supply
Processing methods for plastics: Primary moulding and casting, injection moulding, pressing, calendering, extrusion, blow moulding, foaming, thermoforming
Further processing and finishing: Conditioning, tempering, stretching, bonding, welding, painting, metallising
Tools: Introduction and definition
Injection moulds for thermoplastics: Design of injection moulds, mould design and concepts, mould dimensions, injection moulding machine, mould cavity dimensions, arrangement, gating system, hot runner systems, rheological design, demoulding system, temperature control system, mould maintenance
Sensors in the mould
Extrusion tools: Design criteria, pipe head, profile tool, wide slot nozzle blow moulding tool, blowing heads, sheathing tool

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10	Module Officer: Prof. Dr.-Ing. Bruno Hüsgen
11	Other information: -

Fundamentals of Electrical Engineering					GLET
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4012	125 h	5	3rd sem.	Annual (Winter)	1 semester

	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
1	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: Students understand the basic physical principles of electrical machines and drives and can evaluate, select and apply the different types of machines in an industrial environment. The analysis of equivalent circuit diagrams and operating characteristics is also taught. The students can create simple linear circuits with the help of the complex Analyse and calculate alternating current calculation. The different types of power (active, reactive and apparent power) can be adequately illustrated.
3	Contents: Electrical engineering basics: Power, work, efficiency in mechanics and electrical engineering. Linear inputs R, L and C. Characteristics of periodic stresses. Complex alternating current calculation. Active, reactive and apparent power. Moment formation in electrical machines. Three-phase alternating current. Special electrical machines: Direct current machine, three-phase asynchronous machine, synchronous machine Introduction to modern drive technology and current straightening technology Integrated practical experiment: Operating behaviour, characteristic curve recording
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written examination or oral examination
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Sebastian Hoffmann
11	Other information: -

Fundamentals of Industrial Computer Science					GIN
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4005	125 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After completion of the module, students:

- master the terminology of computer science and are able to understand the logic of programming as well as object orientation.
- have basic knowledge of the functioning of computer systems and can present these.
- are able to structure simple information technology problems and transfer them into solution modules.
- have the ability to solve simple problems independently in the programming language C++/C#.
- have basic knowledge of the application and implementation of simple algorithms and can apply this knowledge in practice.
- have basic competences for the analysis of problems and the structured transformation 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, basic programming using editor, compiler, linker and integrated development environments.
Introduction to object-oriented programming
Introduction to the programming language C++/ C#: General structure of a C++ programme
Variable types, structures
Functions for input and output
Control structures
Functions
Classes/ elements of object orientation
Vectors and pointers
Recursion / Iteration, Modular Programming. Algorithms and data structures
Sorting algorithms 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 Forms of assessment:

Written or oral examination or project work

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Jürgen Sauser
11	Other information: -

Fundamentals of Mechanical Process Engineering					GMVT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4077	125 h	5	7th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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:

The students are able to reproduce the essence of process engineering and to classify and explain the most important basic operations of process engineering and especially of mechanical process engineering in the overall context.
The students know the basic sequence of a process as a result of acting force fields, energy and mass flows and can characterise it. Furthermore, they can map processes for mixing, separating and agglomerating and comminuting substances/substance mixtures. The students can explain the different apparatus and machines for separating mixtures of substances (cyclone, filter, centrifuges). The students are able to dimension a centrifuge for a specific application and optimise the process parameters of a centrifuge in different applications. The students can describe the design and function of disc separators and decanters.

3 Contents:

Introduction to process engineering:
Classification of mechanical process engineering in general process engineering
Distinction from chemical and thermal process engineering
Fluid mechanics and thermodynamics and fundamentals of mixtures
Fluid mechanics fundamentals
Particle description/ distribution
Properties of mixtures
Stokes' sink rate, sedimentation, emulsion
Processes of mechanical process engineering
Separation/mixing (air classifiers, sieves, filters, flocculants, homogenisers, membrane filtration, stirrers)
Size reduction/agglomeration (mill, homogenisers, mazarator)
Conveying/storage (pumps, vibrating screens,...)
Mechanical process engineering /separation technology:
Processes (filter, cyclone, centrifuge), basics of filtration, press filtration, membrane filtration, differences between the processes clarification, separation, dewatering ;
Filter cake
Centrifugal separation technology
Design and function of centrifuges (disc separator and decanter); 2-phase and 3-phase application, process integration, flocculants, material flow balances, heap dewatering

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

	Module examination pass
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Jürgen Hermeler
11	Other information: -

Industrial Management					IBL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4018	125 h	5	4th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are able to

- understand the business management interrelationships in industrial companies.
- carry out investment calculations, both with simple static, as well as with dynamic methods.
- assess the relevance of key performance indicator systems for evaluating different areas of the company.
- make rational decisions to solve problems according to operational goals.
- In the areas of materials management, production, sales and finance, the aim of the project is to address essential functions and solve problems.

3 Contents:

Students are taught the business management way of thinking and basic knowledge from the sub-areas of industrial management.
Objective of the industrial operation
Operational organisation: Process and organisational structure, project management
Materials management: Materials, purchasing, materials planning/quantity planning, warehouse management
Production management: Production planning and strategy, production programme planning, sales-market orientation of the company
Overview of external accounting
Cost types, cost centre accounting, cost unit accounting
Financing and investments
Key figures of controlling

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Michael Fahrig

11 Other information:

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Industrial Control Technology					IST
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4076	125 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students acquire knowledge of the functional principles of programmable logic controllers and their application in technical system solutions and can reproduce and explain them.
They will learn how to configure PLCs with the appropriate input and output modules as well as the selection of suitable sensors and actuators and how to relate these areas to each other.
Students are able to analyse and specify simple automation problems and implement solutions with different programming languages of the PLC world. They can assess the possibilities and limits of conventional and PC-based control technology and select and implement suitable solutions.
The students understand the functioning of basic bus systems of the automation technology and can configure it.

3 Contents:

Principles
Introduction: what is industrial control technology
Areas of application, types of control, control architecture: industrial bus systems (CAN, Profibus, EtherCAT)
Distributed control technology
Decentralised control technology
PLC technology
Structure and function of programmable logic controllers
Operating systems and operating behaviour of PLCs
PLC programming basics IEC61131 architecture
Introduction to programming according to IEC61131-3
Programming of automation applications
Functional safety in control systems
Requirement of safety-related controls IEC 61508 and performance level
Safety controls

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

	Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Sebastian Hoffmann
11	Other information: -

Innovation Techniques					INOT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4079	125 h	5	7th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students understand how to apply innovation techniques and use them in a targeted manner when developing new ideas and new solutions by

- learning basic skills to prepare and facilitate workshops.
- learning the basics of using and selecting different creativity techniques in order to transfer and apply them to specific tasks.
- understanding and evaluating the possibilities and limits of applying innovation techniques and transferring this knowledge to solution finding and product development.

3 Contents:

Innovation and creativity
Innovation techniques in product development and quality management
Basics for setting up a creativity workshop
Selection and combination of different creativity techniques
DFMEA as a tool for the development of new solution ideas

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Oral examination or term paper or project work

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Thomas Kordisch

11 Other information:

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Colloquium					KOL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1290	75 h	3	9th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	In the colloquium, 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 master 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 questions that arose in the context of the work.	
4	Forms of teaching:	
	Oral examination	
5	Participation requirements:	
	Formal:	All modules of the study programme must be successfully completed. The bachelor thesis must be successfully completed.
	Content:	Treatment of the bachelor thesis
6	Forms of assessment:	
	Oral examination for a maximum duration of 75 minutes	
7	Prerequisite for the award of credit points:	
	Passed colloquium	
8	Application of the module (in the following study programmes)	
	Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);	
9	Importance of the grade for the final grade:	
	Percentage based on the sum of credits of the graded modules according to RPO- BA §32	
10	Module Officer:	
	Prof. Dr.-Ing. Michael Fahrig	
11	Other information:	
	-	

Designing with Plastics					KMKS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4080	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: Students are able to reproduce the design and construction guidelines of injection moulded parts and extrusion profiles and apply them to designs. They are able to design and create plastic components suitable for production. During the practical, the students deepen their theoretical knowledge.
3	Contents: Students are taught the design and construction guidelines of injection moulded parts as well as extrusion profiles. Introduction and definitions Moulded part development, process selection, material selection Strength calculation and dimensioning, characteristic value and characteristic function, mechanical behaviour of plastics, molecular orientations, failure case, uniaxial and multiaxial stress states, calculation of mechanical stresses Designing injection moulded parts from thermoplastics and thermosets Designing extrusion profiles Design of welded and bonded joints Tool technology
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written or oral examination (also possible in partial performances)
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Bruno Hüsgen
11	Other information: -

Construction Elements I					KE1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4011	125 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students are able to

- explain the function of the machine elements presented.
- name the advantages and disadvantages of technical alternatives.
- design the basic features of the machine elements presented.
- recall their knowledge from previous basic subjects in order to find solutions for simple constructional problems and to realise them taking into account physical, material, technological and economic aspects.
- document their own constructive proposals for solutions as far as possible in accordance with the standards.

3 Contents:

Students are taught about the function and structure of machine elements as well as their calculation and design.
Basics of construction:
Overview of the design development process, designing with design elements, design according to force, design according to production, stressing of construction elements, tolerances and fits
Fasteners:
Classification system for connections: substance-to-substance connections, form-fit connections, force-fit connections
Bearings:
Friction behaviour of bearings, rolling bearings, plain bearings
Guideways:
Definition and examples of application, requirements, sliding guideways, rolling guideways, kinematic guideways
Axles and shafts:
Definition and properties, strength calculation, deformation calculation, critical speed, design guidelines

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

	Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Michael Fahrig
11	Other information: -

Construction Elements II					KE2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4013	125 h	5	4th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are able to

- explain the function of the machine elements presented.
- name the advantages and disadvantages of technical alternatives.
- design the basic features of the machine elements presented.recall their knowledge from previous basic subjects in order to find solutions for simple constructional problems and to realise them taking into account physical, material, technological and economic aspects.
- document their own constructive proposals for solutions as far as possible in accordance with the standards.

3 Contents:

Students are taught about the function and structure of machine elements as well as their calculation and design.
Springs:
Ordering criteria, spring characteristics, spring work, damping, interaction of springs,
Mould rating, metal springs, elastomer springs, gas springs
Clutches:
Balanced clutches, manual clutches, hydraulic clutches
Brakes:
Outside shoe and inside shoe brake, disc brake, band brake, friction materials for brake pads
Traction gear:
Structure and properties of traction elements, criteria for the selection of the traction element, calculation of belt drives, chain drives
Gear drives:
Theoretical principles of gearing, pinion gearing, helical gears, helical gears, bevel gears, worm drive, materials of the gears, strength calculation, permissible surface pressure, gearbox structure

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

	Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Michael Fahrig
11	Other information: -

Lightweight Materials					LWS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4069	125 h	5	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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: learn about the special aspects and characteristic values of constructive lightweight construction and can apply these when evaluating and selecting materials, understand the specific material behaviour of different lightweight construction materials and can compare and analyse them with each other, can explain the specific properties of the material groups with the microstructure and the alloy concept, develop skills to evaluate the application potential of different material groups with regard to lightweight construction potential and to apply them in component design.
3	Contents: Basics of relevant material parameters for lightweight construction to understand the material requirements Lightweight potential and special material properties as well as alloying and microstructural features of the following material groups: High-strength steels Aluminium alloys Magnesium alloys Titanium alloys Composite materials Application examples of lightweight materials
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written examination or oral examination
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Thomas Kordisch
11	Other information: -

Mathematics I					MAT1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4002	125 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are familiar with the different number ranges, as well as the basics of set theory and elementary logic. They are able to determine the solution sets of inequalities and master the safe handling of complex numbers.
The students know the basics of real number sequences and infinite series. They are familiar with real functions, the most important special functions and their characteristic properties. In addition, they master the differential calculus of real functions and can apply this to practice-oriented issues.

3 Contents:

Fundamentals: Number ranges, set theory, elementary logic, inequalities
Complex numbers: Gaussian number plane, polar and exponential form, conversion of the forms of representation, basic arithmetic operations, exponentiation, root extraction and logarithmic operations
Sequences and series: Number sequences, properties and limit value of a sequence, infinite series, convergence criteria
Real functions: Definition and representation of real functions, calculation with real functions, properties, limit and continuity of real functions
Special functions: Integral functions, fractional functions, exponential functions, logarithm functions, trigonometric functions
Differential calculus: Differential quotient, rules of derivation, special derivation techniques, rules of de L'Hospital, curve sketching

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Sabine Lüke M.Sc.

11 Other information:

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Mathematics II					MAT2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4006	125 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are familiar with power series and their properties, as well as with Taylor series. They know the basic concepts of integral calculus and can integrate real functions using the techniques covered.
The students know the basic concepts of vector calculus, master the various arithmetic operations with vectors and are able to apply them in geometric contexts. They are confident in dealing with matrices and determinants and can use them to solve linear equation systems.

3 Contents:

Power series: Convergence behaviour, properties, Taylor series
Integral calculus: Definite and indefinite integrals, integration rules, main theorem of differential and integral calculus, basic or master integrals, integration methods, application of integral calculus
Vector calculus: Vector operations, scalar product, n-dimensional vector space, linear dependency, vector product, triple product, vectorial representation of geometric relationships
Linear algebra: Calculating with matrices, matrix product, matrix representation of systems of linear equations, row normal form, Gauss-Jordan method, solvability of systems of linear equations, inverse matrices, determinants

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Sabine Lüke M.Sc.

11 Other information:

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Mathematics III					MAT3
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4009	125 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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: The students are familiar with ordinary differential equations of the 1st order, as well as with systems of linear differential equations with constant coefficients. They are able to set up and solve linear differential equations with constant coefficients. The students know the basics for functions of several variables. They have mastered the differential calculus of several variables and can apply it in equalisation and error calculus.
3	Contents: Ordinary differential equations: diff. equ. of 1st order, linear equations of nth order, superposition theorem, product theorem, fundamental systems, exponential theorem, characteristic equation, oscillations, special solution of the inhomogeneous equation, systems of linear equations with constant coefficients Functions of several variables: Definition area, limit value and continuity, Partial and total differentiability, gradient and directional derivative, differentiation, Taylor's theorem, determination of extrema
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: Mastery of the learning content of the modules Mathematics I and Mathematics II
6	Forms of assessment: Written examination or oral examination
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Sabine Lüke M.Sc.
11	Other information: -

Measurement and Control Technology					MURT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4074	125 h	5	7th sem.	Annual (Winter)	1 semester

	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
1	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the module, students will be able to

- relate definitions, calculations and measurements to each other.
- determine electrical measurands.
- detect and interpret measurement errors.
- describe the structure of important electrical measuring instruments.
- carry out practical experiments themselves.

3 Contents:

First, the general basics of measurement technology are worked out, and then the basics of electrical measurement, preferably of electrical measurands, are elaborated. Essential learning 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:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Sebastian Hoffmann

11 Other information:

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Physics					PHY1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4004	125 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students:

- are familiar with the SI system and confidently transform physical quantities and units.
- understand the nature of a physical measurement process.
- recognise basic physical relationships.
- solve simple kinematic and dynamic problems using the basic equations.
- understand the meaning of physical conservation laws and are able to apply them.
- know the basic phenomena of acoustics and optics and can reproduce them.
- carry out physical experiments and evaluate the results.
- write laboratory reports according to the general method.

3 Contents:

Basic concepts of physics:
Systematics of physical quantities, SI units, definition of elementary physical quantities (e.g. length, time, mass, density, force, pressure, mechanical stress, temperature, heat capacity, viscosity)
Physical measurement process:
Measurement systems, graphical representations, measurement deviation and error propagation
Kinematics:
Basic kinematic variables in translation and rotation (location, angle of rotation, (angular) velocity, (angular) acceleration, path-time diagrams, uniform (rotary) motion, uniformly accelerated (rotary) motion
Dynamics:
Newton's axioms, inertial mass, moment of inertia, gravitation, mechanical forces, friction, apparent forces (centripetal force, Coriolis force)
Physical work and energy:
Definition of work, energy, power, efficiency and effectiveness; forms of energy, law of conservation of energy with applications
Momentum and angular momentum:
Definition of momentum and angular momentum, connection with forces and moments, law of conservation of momentum and angular momentum with applications
Elementary vibration theory:
Periodic processes, kinematics and dynamics of harmonic oscillations, undamped and damped, free and forced oscillation
Elementary wave phenomena using the examples of acoustics and optics
Technical acoustics:
Sound waves and superposition, sound propagation, sound pressure, sound level and A-weighting, sound attenuation and sound insulation
Optics:
Wave optics (interference and diffraction, reflection, transmission, refraction, total refraction), geometrical optics (optical imaging, simple optical instruments)

4	Forms of teaching:	
	Learning units for self-study, classroom events in the form of exercises and practicals	
5	Participation requirements:	
	Formal:	-
	Content:	-
6	Forms of assessment:	
	Written examination or oral examination	
7	Prerequisite for the award of credit points:	
	Module examination pass and course assessment	
8	Application of the module (in the following study programmes)	
	Mechanical Engineering (part-time combined studies) (B.Eng.);	
9	Importance of the grade for the final grade:	
	Percentage based on the sum of credits of the graded modules according to RPO- BA §32	
10	Module Officer:	
	N. N.	
11	Other information:	
	-	

Product Risk Management					PUR
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4067	125 h	5	7th sem.	Annual (Winter)	1 semester

	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
1	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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: The students possess the technical and methodological competences with regard to risk identification, analysis and assessment for technical products. They can use the instruments required for this in relation to different technical products and develop instruments for risk minimisation for these products and evaluate the success of the measures introduced under technical and business management aspects.
3	Contents: Risk types/ risk identification Methods of risk analysis and risk ranking Methods of technical risk assessment Instruments and processes of risk management Integration of risk management into the product development cycle Instruments of evaluation and documentation
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written or oral examination or term paper
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Eva Schwenzfeier-Hellkamp
11	Other information: -

Production Automation and Digitalisation					PAUD
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4072	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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:

- can reproduce the basics of current factory organisations
- can classify basic technologies of production automation and digitalisation in the context of the buzzword "Industry 4.0", as well as critically question their implementation possibilities
- understand the key principles behind the concepts of a "factory of the future"
- can assess the potential and degree of complexity of forward-looking production scenarios

3 Contents:

The module first provides an insight into the structure, business processes and set-up of a company. It deals with important topics of today's factory organisation.
In the further course, students are taught the essential technology drivers behind the buzzword "Industry 4.0". Building on the technologies presented, an outlook is given on the production of the future as predicted by many experts. Real-life examples will be used to present aspects of this vision of the future that are already being implemented today.
Fundamentals of production, especially in the context of automation
Requirements of the factory/production for product automation
Basic technologies 4.0
3D Printers - Cyber Physical System - Sensitive Robots - Human-Machine Interaction - Big Data - Cloud Computing - Real Time Enterprise - Vertical/Horizontal Integration - Digital Factory - Predictive Maintenance
Concepts of the factory of the future
Digital business processes - Production system - Decentralised coordination - Management processes - Open value chain - Flexible production - Global activities (Advanced Manufacturing, Industry 4.0, Intelligent Manufacturing, e- Factory,...)
The human factor in digitalised industry
Assistance systems
Process monitoring as an essential component in the automation of networked production systems. Sensors, monitoring strategies through to teleservice
"Resource-efficient production"
Exemplary implementations in companies
In the exercises, the methods are applied to industry-related tasks through the use of modern IT tools and through exercises in the InProSys learning factory, as well as supplemented with examples from industry and solution providers.

4 Forms of teaching:

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

5 Participation requirements:

	Formal:	-
	Content:	-
6	Forms of assessment: Written or oral examination or project work	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);	
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32	
10	Module Officer: Prof. Dr.-Ing. Jürgen Sauser	
11	Other information: -	

Production Management and Factory Organisation					PMUS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4070	125 h	5	7th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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:

The students acquire a basic understanding of operational IT systems and applications for the control and management of production processes. They are able to apply and link this understanding in operational processes. In this context, they will also be able to apply the basic and factual knowledge they have acquired in a future-oriented manner in everyday business life. They can apply their knowledge of lean management and factory organisation in practice.

3 Contents:

Organisation and control of production
Basics of IT systems in industrial application, basics of process and information management
Process definitions and IT systems to support industrial manufacturing (ERP, MES, PLM, PDM, SCM)
Integration of IT systems
The Digital Factory
Perspectives and outlooks of the factory of tomorrow

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written or oral examination or project work

7 Prerequisite for the award of credit points:

Module examination pass

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Jürgen Sauser

11 Other information:

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Project Management					PM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4029	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		actual Contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are able to

- carry out the basic tasks of project organisation and project management
- describe the detailed procedure for working on projects
- manage a project in a given procedural project organisation
- describe the sequence and schedule planning with network plans and draw up capacity and cost planning on the basis of network plans
- apply the elementary technical vocabulary regarding project organisation and project management
- explain the specifics of team building and project management

They understand how to successfully motivate oneself and teams effectively.
They understand the importance of corporate goals and are able to distinguish between different leadership cultures.

3 Contents:

The basics and practical application of project management are presented
Terms and definition, aspects of problem-solving and decision-making processes, project organisation and project management
Project phases and planning systems (project preparation, project planning, project implementation, project completion)
Project management in the organisational structure
Tools of project management
Project management as a management tool
Social, technical and methodological competence
Innovation and change management
Self-management
Target tracking and project controlling

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Oral examination or term paper or project work

7 Prerequisite for the award of credit points:

Module examination pass

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

	Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Michael Fahrig
11	Other information: -

Quality Management					QMM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4033	125 h	5	9th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students are able to:

- assess the differences between the various QM systems.
- introduce and audit QM systems.
- introduce UM and AS systems.
- shape customer loyalty within the framework of a QM system.
- apply the continuous improvement process and QM methods.

Furthermore, the students have knowledge that enables them to:

- apply the statistical methods dealt with appropriately to technical tasks in order to obtain and evaluate information from data material, prepare decisions under uncertain conditions, check the suitability of technical processes.
- present the results obtained from statistical investigations; and assess them with regard to correctness and significance.

3 Contents:

The students work out the basics of quality management (QM) and its importance in the company for customer satisfaction.
Basic concepts of quality management:
Quality, audit, error, corrective action
Standardisation of quality management systems:
DIN EN ISO 9001:2000, ISO/TS 16949:2002, QS-9000, VDA 6.1
Process-oriented quality management system:
Measurement of processes with key figures, introduction of the QM system, documentation, electronic QM system, internal auditing of QM systems
Environmental management and occupational health and safety management systems
Customer orientation
Continuous improvement process QM methods
Basic concepts of probability theory:
Random experiments and events, probability space (relative frequency, the probability measure, Laplace experiments, statistical probability), conditional probability (definition of conditional probability, tree diagrams, total probability and Bayesian formula, independent events), Bernoulli experiments and Bernoulli chains
Methods of statistics:
Descriptive statistics (basic terms, empirical frequency distribution, class formation for samples, characteristics of samples, frequency distribution of two-dimensional samples, covariance and correlation coefficient, straight regression), evaluative statistics (sample size and confidence interval, estimations of parameters, testing of hypotheses)

4 Forms of teaching:

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

5 Participation requirements:

	Formal:	-
	Content:	-
6	Forms of assessment: Written exam or combination exam	
7	Prerequisite for the award of credit points: Module examination pass and course assessment	
8	Application of the module (in the following study programmes) Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);	
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32	
10	Module Officer: Prof. Dr.-Ing. Prof. h.c. Lothar Budde	
11	Other information: -	

Rapid Prototyping / Additive Manufacturing					RPAF
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4071	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: The students know the common procedures with their advantages and disadvantages. They can classify and evaluate the use of these processes for industrial applications from an economic and technological point of view. After successful participation, the students are able to plan and evaluate the use of these processes for different industrial applications, taking into account the process-specific advantages and disadvantages as well as the manufacturing and material costs, and to compare their general use with the conventional processes with critical reflection.
3	Contents: Overview of the current additive/generative processes, definition of stereolithography, selective laser sintering, fused layer processes, three-dimensional printing, layer laminate processes, etc. Data generation and process chain, rapid prototyping, rapid tooling Integration of additive manufacturing in process chains, direct manufacturing New value creation with additive manufacturing/Economic considerations/Quality aspects The path to individual production
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written or oral examination or project work, possibly also possible as partial assessments
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Bruno Hüsgen
11	Other information: -

Fluid Mechanics and Flow Machines					STL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4019	125 h	5	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are able to:

- calculate pressure forces exerted on bodies and walls by liquids at rest.
- calculate flow quantities of incompressible flows by applying the law of conservation of energy.
- calculate pressure losses of liquid-carrying pipelines.
- dimension and select pumps / fans for applications.
- assess the operating behaviour of pumps and the interaction with consumers in piping networks.
- outline cavitation, NPSH values of pumps, structure and function of basic types of pumps.

3 Contents:

The students are taught basic contents of fluid mechanics. They will receive an overview of the fluid mechanical processes that frequently occur in engineering practice.
Physical properties of fluids
Hydrostatics: Definition of pressure, hydrostatic pressure, directional independence of pressure, pressure propagation, communicating vessels, pressure forces on plane and curved walls, hydrostatic buoyancy
Basic concepts of fluid dynamics
Energy equation of stationary, frictionless flow: Energy equation of the ideal fluid (Bernoulli equation), static and dynamic pressure, frictional flow (real fluids): viscosity, flow forms of real fluids (laminar and turbulent flow), energy equation of real fluid flow, pressure loss in pipelines and in piping elements, incompressible fluids with energy supply (turbomachines), specific statute work, pump, turbine, velocity triangles, Euler's turbine equation, general outline of centrifugal pumps and fans (design and function, cacitation, NPSH value, operating behaviour, influence of compressibility)
Basic principles of the design and dimensioning of pumps and fans

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

	Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Jürgen Hermeler
11	Other information: -

Didactics of Technology					TDD
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4047	125 h	5	8th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students are able to

- formulate and justify the objectives, contents and standards of vocational education and training in the industrial-technical occupations in the context of the training objective,
- plan, prepare, implement and evaluate technology lessons,
- systematise the methods and media specific to technology teaching, to select and use them in a way that is appropriate to the content and the target group, and to incorporate subject-specific features of mechanical engineering and electrical engineering into didactic concepts,
- carry out and subsequently reflect on a teaching sequence, to structure subject content in a learning field-oriented manner and to transform it didactically,
- select suitable forms of examination and justify the selection.

3 Contents:

Didactic principles of the vocational specialisations (e.g. learning field concept in mechanical and electrical engineering occupations)
Theories, models, methods and media (e.g. planning of teaching and learning processes, problem-solving strategies in activity-oriented teaching)
Use of modern communication, presentation and learning technology,
Educational goals and standards, framework curricula and guidelines of the relevant German federal state (NRW)

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Performance test

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Thorsten Jungmann

11 Other information:

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Technical Documentation					TDOC
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4001	125 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students are able to:

- produce standardised technical drawings of simple components and assemblies.
- dimension the components in a way that is suitable for production.
- specify tolerances of individual dimensions and tolerance chains.
- create parts lists of assemblies.
- select semi-finished products.

3 Contents:

Basics of standard-compliant representation in machine, plant and equipment construction: Elements of a technical drawing: Formats, title block, scales, projections and views, lines, labels, sectional views
Drawing and dimensioning suitable for production: Elements of dimensioning, arrangement of dimensions and special features in representation and dimensioning, types of dimensioning
Special representations and dimensioning: Thread and screw illustration, rolling bearing illustration and arrangement, gear illustration, construction and illustration of shafts, weld illustration
Tolerances and fits: Tolerance specifications, ISO tolerance system, fitting systems: Standard bore, standard shaft, general tolerances (free size tolerances), form and position tolerances
Surface details
Materials, semi-finished products and heat treatment
Designing for production and materials during casting
Practical course with several selected application examples (workpiece recording, drawing preparation, parts list preparation, tolerance analysis) to acquire and consolidate the competences for reading and preparing technical drawings and for production-oriented and tolerance-oriented design as well as semi-finished product selection

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written exam or combination exam

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

	Prof. Dr.-Ing. Herbert Funke
11	Other information: -

Engineering Mechanics I					TME1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4003	125 h	5	1st sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are able to ...
... apply the axioms of statics.
... create free-body images.
... carry out equilibrium investigations analytically on manageable planar or spatial technical examples.
... calculate focal points.
... analyse stability problems.
... analyse force systems with friction.

3 Contents:

Students learn the basic interrelationships of statics as the study of the equilibrium of forces in and on mechanical structures at rest and how to apply its methods.
Introduction: Delimitation of topics, conventions
Fundamentals of statics: Concept of force, axioms of statics
Central plane system of forces
General plane force system
Determining the bearing reactions for single-part systems of rigid bodies in the plane
Determining the bearing and intermediate reactions for multi-part systems of rigid bodies
Focus: Body, volume, area, line centre of gravity, stability, Guldin's rules
Friction: Static and dynamic friction, rope friction, rolling resistance
The spatial force system

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Raimund Kisse

11 Other information:

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Engineering Mechanics II					TME2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4007	125 h	5	2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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:

The students are able to carry out strength checks for simple statically or dynamically stressed components using relevant material parameters. They learn the basic relationships between external loads and the resulting internal stresses and deformations and are able to reproduce these and transfer them to practical applications.

3 Contents:

Introduction: Delimitation of topics, conventions
Tensile/compressive loading
Assessment of failure under static loading
Deformation and thermal stresses
Vibratory stress on notch-free components
Stress on notched components
First and second order moments of area, moments of resistance
Internal forces on the beam
Bending stress
Torsional stress
Shear force-induced shear stresses in bending beams
Buckling stresses
Multi-axial stress states and equivalent stresses

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

Prof. Dr.-Ing. Raimund Kisse

11 Other information:

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Engineering Mechanics III					TME3
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4010	125 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are able to analyse, design and dimension mechanical movement processes. They have the skills to assign and apply suitable solution methods to dynamic problems. They can calculate and evaluate movement processes and loads.	
3	Contents:	
	Introduction to the topic delimitation Kinematics: Kinematics of the point, kinematics of the disc Kinetics: Kinetics of the mass point, pure translational motion; work, energy, power; momentum, momentum theorem, momentum conservation law for mass points; motion of a body in a medium; rotation of a body about a fixed axis; work, energy, power in rotational motion; momentum, momentum theorem, momentum conservation law in rotational motion; general, planar motion of a rigid body	
4	Forms of teaching:	
	Learning units for self-study, classroom sessions in the form of exercises	
5	Participation requirements:	
	Formal:	-
	Content:	-
6	Forms of assessment:	
	Written examination or oral examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Mechanical Engineering (part-time combined studies) (B.Eng.);	
9	Importance of the grade for the final grade:	
	Percentage based on the sum of credits of the graded modules according to RPO- BA §32	
10	Module Officer:	
	Prof. Dr.-Ing. Raimund Kisse	
11	Other information:	
	-	

Technical English					TENG
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4026	125 h	5	62nd or 6th sem.	Annual (Summer)	1 semester

	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
1	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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:

- 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.

3 Contents:

- The students can describe relevant engineering disciplines.
- They master the core terminology of the technical topic (e.g. base units in engineering; dimensions and shapes; mathematical operations; forces and mechanisms; properties of materials; manufacturing and automation; energy and electricity; logistics; data processing and transmission).
- They possess interdisciplinary skills (emailing; project work; presentation techniques; discussing diagrams).

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Combination examination

7 Prerequisite for the award of credit points:

Module examination pass

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

Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module Officer:

OStR Cornelia Biegler-König

11 Other information:

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Thermodynamics					TDY
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4014	125	5	5 or 7 respectively	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students are able to:

- apply basic thermodynamic concepts safely and simplify thermodynamic problems.
- set up and solve mass and energy balances.
- assess energy conversions.
- apply and distinguish between laws for ideal and real fluids.
- calculate and evaluate idealised circular processes.
- explain the structure and function of an internal combustion engine; explain the thermodynamic differences between petrol and diesel engines; explain the difference between 2-stroke and 4-stroke engines.
- solve simple problems of heat transfer.

3 Contents:

The thermodynamic and material basics for technical energy conversions and transfers as well as the basics for questions of rational energy conversion are taught.
Thermodynamic basics: Open, closed, confined, homogeneous, heterogeneous and adiabatic systems, system boundary, thermal, specific and molecular state variables, processes, ideal gas, thermal equation of state
First law of thermodynamics: Heat, work, enthalpy, internal energy, power, specific heat capacity, law of conservation of energy
Second law of thermodynamics: Irreversibility, dissipation, entropy
Reversible changes of state: Application of the thermal equation of state, application of the first and second law for reversible isobaric, isothermal, isochoric, isentropic and polytropic changes of state, p/v diagram
Real fluids: p/v/T-, log p/h-, T/s- and h/s-diagram for real fluids, two-phase area, boiling line, dew line, saturated and superheated steam, steam content, steam pressure, boiling temperature
Circular processes: supercritical and subcritical process, ideal comparative process (Joule, Clausius Rankine), isentropic, Carnot and thermal efficiency, internal combustion engines, diesel and petrol engines, gas turbines in the Joule process, course of processes in p/v, log p/h, T/s and h/s diagrams
Structure and function of an internal combustion engine; diesel and petrol engine; 2-stroke and 4-stroke engine
Heat transfer: Heat conduction, natural and forced convection, heat transfer, heat transmission, heat radiation, heat carrier

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Jürgen Hermeler
11	Other information: -

Elective Project					WP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4044	125 h	5	5th or 6th sem. respectively	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	46.5	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 are able to work on a task from the operational environment or a research project alone or in a small group. They can define the content and boundaries of the project. They can break down a complex question into subtasks for processing and combine the subtasks again in a meaningful way at the end. They are able to independently research, evaluate and select information on the topic and make it usable for the research question. They can select suitable technical methods to carry out necessary experiments, series of measurements, examinations, etc. They can justify the steps of their actions in a meaningful way and document and present their results appropriately to an audience.
3	Contents: Basics of project management Project planning Timing Cooperation and division of tasks in the team Independent processing of a technical task with time, economic and production-related specifications Documentation techniques Presentation techniques
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Project work, presentation
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Electrical Engineering (part-time combined studies) (B.Eng.); Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Michael Fahrig
11	Other information: -

Plastics Engineering					WKK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4030	125 h	5	4th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: The students know the material-specific characteristics of plastics and the resulting advantages and disadvantages of the material. They are able to assess the properties and areas of application of the various plastics and to select the different materials in an engineering-oriented manner, taking into account manufacturing and operating conditions.
3	Contents: Plastics in practice: What is plastic? Production and history, processing The structure of matter: Periodic table of the elements, the chemical bond, from monomer to macromolecule Polymeric materials: Thermoplastics, duromers, conventional elastomers (rubber), thermoplastic elastomers, nomenclature and abbreviations for polymers, overview of the selected material classes, economic and technological considerations Molecular weight distribution: Molar mass distributions and mean values of molar mass The synthesis of polymers: Types of polymer build-up reactions, Phase transitions: Glass transition, crystallinity, amorphous and semi-crystalline plastics Rheology of plastics: Structural viscosity, non-Newtonian flow, energy and entropy elasticity Importance of additives: Antioxidants, light stabilisers, antistatic agents, etc. Influence of the manufacturing conditions on the material properties
4	Forms of teaching: Learning units for self-study, classroom events in the form of exercises and practicals
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written or oral examination or term paper, possibly also in partial performances possible
7	Prerequisite for the award of credit points: Module examination pass and course assessment
8	Application of the module (in the following study programmes) Mechanical Engineering (part-time combined studies) (B.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- BA §32
10	Module Officer: Prof. Dr.-Ing. Bruno Hüsgen
11	Other information: -

Metal Engineering					WKI
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4016	125 h	5	4th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	62.5	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	38.5	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students understand the relationships between the structure of metallic materials and their properties by

- acquiring knowledge about the microstructural composition as well as its modification by alloying elements,
- understanding the deformation behaviour as well as the transformation behaviour and phase reactivities,
- developing skills to apply material parameters to different operating conditions and transferring these to the component design
- acquiring the competence to measure and evaluate material properties within the framework of a material test and to cause changes in the material behaviour by applying heat or mechanically deforming them

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 diagram, 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 steels and tool steels, cast iron.
Selected areas of materials testing and materials properties will be enhanced in practicals.

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written or oral examination or term paper

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

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

Mechanical Engineering (part-time combined studies) (B.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32