Appendix A

Course schedule for the part-time combined study programme Electrical 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**
Fundamentals of Electrical Engineering	5	4	2	-	1	1	24
Mathematics I	5	4	2	-	2	-	16
Physics I	5	4	2	-	2	-	16
Materials of Electrical Engineering	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**
Second semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Fundamentals of Electrical Engineering II	5	4	2	-	1	1	24
Mathematics II	5	4	2	-	2	-	16
Physics II	5	4	2	-	1	1	24
Technical English	5	4	2	-	2	-	16
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**
Third semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Fundamentals of Energy Technology	5	4	2	-	2	-	16
Mathematics III	5	4	2	-	2	-	16
Electronics	5	4	2	-	2	-	16
Metrology	5	4	2	-	1	1	24
Totals	**20**	**16**	**8**	**-**	**7**	**1**	**72**
Fourth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Electrical Machines	5	4	2	-	1	1	24
Mathematics IV	5	4	2	-	2	-	16
Industrial Management	5	4	2	-	2	-	16
Computer Science	5	4	2	-	2	-	16
Totals	**20**	**16**	**8**	**-**	**7**	**1**	**72**
Fifth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Applied Computer Science	5	4	2	-	2	-	16
Power Systems	5	4	2	-	2	-	16
Control Engineering	5	4	2	-	1	1	24
Efficient Illumination Technology	5	4	2	-	2	-	16
Totals	**20**	**16**	**8**	**-**	**7**	**1**	**72**
Sixth semester	**ECTS**	**SCH**	**L**	**ST**	**E**	**P**	**Classroom teaching**
Automation Systems	5	4	2	-	1	1	24
Energy Systems	5	4	2	-	2	-	16
Power Electronics	5	4	2	-	1	1	24
Elective Project	5	4	2	-	2	-	16
Totals	**20**	**16**	**8**	**-**	**6**	**2**	**80**

Seventh semester	ECTS	SCH	L	ST	E	P	Classroom teaching
Product Risk Management	5	4	2	-	2	-	16
Power Drive 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**
Project Management	5	4	2	-	2	-	16
Renewable and Conventional Power	5	4	2	-	1	1	24
Compulsory Elective Module III	5	4	2	-	2	-	16
Compulsory Elective Module IV	5	4	2	-	2	-	16
Totals	**20**	**16**					**64**
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**

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

Legend:

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

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: Energy and Automation Technology	ECTS	SCH	L	ST	E	P	Classroom teaching
CEM I: Modern Energy Policy	5	4	2	-	2	-	16
CEM II: Thermodynamics	5	4	2	-	1	1	24
CEM III: Mechatronic Systems	5	4	2	-	2	-	16
CEM IV: High-Voltage Technology	5	4	2	-	2	-	16
Totals	**20**	**16**	**8**	**-**	**7**	**1**	**72**

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

Appendix B

Module catalogue

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

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

As of: 19 January 2021

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General Didactics and Orientation Practical					ADOP
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4078	125 h	5	Supplementary 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 education and are able to draw further boundaries to neighbouring disciplines and reference disciplines as well as to identify subject areas and functions of didactics.
- are able to distinguish selected didactic theories and models from each other 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 use them for their own teaching encounter in the orientation practical internship.
- are able to critically question this knowledge, to modify resulting questions into exploratory questions and to systematically elaborate them during the orientation practical internship.
- reflect on their own developmental process and in doing so 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 coordinator:

Prof. Dr.-Ing. Thorsten Jungmann

11 Other information:

	-

Applied Information Technology					AINF
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4058	125 h	5	5th 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: Students have an understanding of basic procedures for developing complex programmes and can deal with the relevant technical terms. They can develop simple object-oriented programmes, including graphical user interfaces with the help of an appropriate standard framework.
3	Contents: Contents: Theory and practice of object-oriented programming e.g. in the language C++ Graphical aids for design, e.g. UML class diagrams Working with software libraries and APIs Basics of files and streams Error handling, exceptions Use of an exemplary standard tool for the construction of graphical user interfaces Event-based programming Developing and presenting as well as discussing approaches and solutions to tasks and more extensive problems
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) Electrical 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 coordinator: Prof. Dr. rer. nat. Jörn Loviscach
11	Other information: -

Power Drive Technology					ATT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4066	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 are able to completely select converter-fed drives for any practical application and describe them in terms of control technology. They can determine the optimal controller parameters of a cascade structure in the frequency domain and the technical realisation with operational amplifiers (analogue) or microcontrollers (digital).
3	Contents: Mechanical and dynamic requirements on the shaft (four-quadrant operation) Project planning and dimensioning of controlled electric drives Selection of suitable machine - converter combinations Position-speed-torque cascade structure and its control description (Laplace transform) Determination of the controller parameters with the help of the frequency characteristics in the Bode diagram and their analogue and digital realisation Fields of application of electrical drive 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 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.);
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 coordinator: Prof. Dr. Ing. habil. Klaus Hofer
11	Other information: -

Automation Systems					ATS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4025	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:	
	Graduates of the module are able to design, configure or programme automation systems and solve simple automation tasks.	
3	Contents:	
	Design and structure of automation systems Programmable logic controller Networked automation systems Process visualisation, MMI Current trends and new developments	
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)	
	Electrical 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 coordinator:	
	N. N.	
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 special subject area, both in the subject-specific details and in the interdisciplinary contexts, using scientific methods within a specified period of time.									
3	Contents: The bachelor thesis is an independent scientific work from the subject area of the respective study programme with a description and explanation of its solution. It can be derived from current research projects at the university or from operational problems with an engineering character. It can also be 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 coordinator: Prof. Dr.-Ing. Michael Fahrig									
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 thereby also examine motives for their own career path.
- are able to identify the requirements for company and school educators and understand vocational education as a profession in this context.
- 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 as well as 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 coordinator:

Prof. Dr.-Ing. Thorsten Jungmann

11 Other information:

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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 on 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 systematic and theoretically sound manner, taking into account existing criteria of academic 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 coordinator:

Prof. Dr.-Ing. Thorsten Jungmann

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 structure of diagnostic competence in the context of pedagogical action and can assess and/or derive 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 didactic concept for higher education.
- differentiate selected learning theories from each other and are also able to justifiably point out application references from the different theories. 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 coordinator: Prof. Dr.-Ing. Thorsten Jungmann
11	Other information: -

Efficient Illumination Technology					ELTE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4061	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: The students know the differences between the basic electrical and light parameters and can illustrate them. They are familiar with the most common methods and tools for measuring basic lighting parameters. Students will be able to plan, analyse and design lighting systems in accordance with the applicable standards and relate them to each other.
3	Contents: Light and basic photometric quantities Photometric measurements Light sources: Properties and characteristic values of lamps and luminaires Thermal radiators (incandescent and halogen lamps) Discharge lamps (low-pressure and high-pressure discharge lamps) Light-emitting diodes (inorganic and organic light-emitting diodes) Luminaires: Elements of light control Luminaire requirements and principles (e.g. indoor and outdoor luminaires) Lighting design using simulation programs Intelligent light control Energy considerations according to applicable standards
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.);
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 coordinator: Prof. Dr.-Ing. Eva Schwenzfeier-Hellkamp
11	Other information: -

Electrical Machines					ELM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4054	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 can understand the mathematical description and the magnetic properties, as well as the equivalent circuit diagrams, pointer diagrams and locus curves of electrical machines and transformers. They will be able to design electrical machines for more complex drive systems and recognise the steady-state and dynamic relationships between the electrical, magnetic and mechanical variables.
3	Contents: Motor and generator properties of electrical machines direct current machines, transformers, three-phase machines, linear motors modern control and regulation methods for electrical machines Small and special motors for precision engineering and information technology Laboratory exercises: Measurement of the characteristics of a DC machine Short-circuit and no-load measurement of a transformer Measurement of the characteristics of a three-phase asynchronous machine
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.);
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 coordinator: Prof. Dr. Ing. habil. Klaus Hofer
11	Other information: -

Power Systems					ELN
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4059	125 h	5	5th 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 know the calculation methods for calculating electrical networks and can apply them. They can calculate the load flow for a specific task. They can analyse symmetrical and non-symmetrical error cases and treat them mathematically.
3	Contents: Standardisation to related network data (per unit values) Calculation of energy transmission systems and networks Network protection and control technology Operation of electrical supply networks Network regulation Symmetrical short-circuit currents Symmetrical components Treatment of unbalances Star point treatment
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.);
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 coordinator: Prof. Dr.-Ing. Jens Haubrock
11	Other information: -

Electronics					ELK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4052	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 recognise the physical properties and effects of PN transitions. Based on this, they will understand the characteristics, curves and models and verify the possible applications of diodes, bipolar and MOSFET transistors. They understand the basic circuits of the above-mentioned components, dimension them correctly and are able to assemble them and check them for faults.

3 Contents:

Diodes
Parameters, diode types, models, characteristics and data sheets
Rectifier circuits
Voltage stabiliser with Z-diode
Voltage multiplier
Bipolar transistor
Design, operating principle, types, characteristic curves, model parameters and data sheets
Voltage stabilisation and constant current source with bipolar transistor
Operating point stabilisation and AC voltage amplifier
Field effect transistor
Design, operating principle, types, characteristic curves, model parameters and data sheets DC and AC voltage applications
Application of transistors as switches in switching power supplies

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.);

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 coordinator:

N. N.

11 Other information:

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Energy Systems					ESY
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4073	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:	
	Graduates of the module are able to describe and explain the basic structure of energy systems for the supply of electricity and heat. They can represent the components of decentralised energy systems and combine them. They have mastered the basic contexts for modelling decentralised energy systems and can manage energy systems competently.	
3	Contents:	
	Design and structure of decentralised energy supply systems Selected combined heat and power plants Virtual power plants with control and regulation Smart grids and micro grids Energy and load management systems	
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 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.);	
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 coordinator:	
	Prof. Dr.-Ing. Jens Haubrock (Dr. Thomas Wehlage)	
11	Other information:	
	-	

Renewable and Conventional Power					EKE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4068	125 h	5	8th 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	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 are able to explain and evaluate the technologies for the use of renewable energy sources for power generation. Furthermore, they can design and calculate these systems. They can describe, dimension and design conventional electricity generation plants and combined heat and power plants.	
3	Contents:	
	Renewable energy supply Use of renewable energy sources CHP plants Conventional power plants	
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 combination 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.);	
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 coordinator:	
	Prof. Dr.-Ing. Jens Haubrock	
11	Other information:	
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Electrical Engineering I					GET1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4084	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: The students have knowledge of the terms of electrical engineering and can explain them. They are able to represent and calculate electrical direct current circuits. Furthermore, they can apply methods for calculating electrical networks. They can understand the basics of electric fields (static field and flow field) and apply them.
3	Contents: Lecture and seminar: Basic physical terms in electrical engineering Two poles, four poles Calculation of electrical circuits Equivalent circuits Calculation of electrical direct current networks Electrostatic field, electric flow field, stationary magnetic field Practicals: Voltage source Temperature-dependent resistance Magnetic circuit
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
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.);
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 coordinator: Prof. Dr.-Ing. Jens Haubrock
11	Other information: -

Electrical Engineering II					GET2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4015	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 can describe, explain and calculate the properties of electromagnetic fields. They can calculate, measure and analyse linear AC and three-phase systems.
3	Contents: Lecture and seminar: The time-varying electromagnetic field AC voltage and AC current Complex alternating current calculation Energy and power in alternating current Symmetrical three-phase systems Power and energy with symmetrical load Practicals: Modelling of real passive components Characteristics of AC circuits Symmetrical/unbalanced three-phase network
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
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.);
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 coordinator: Prof. Dr.-Ing. Jens Haubrock
11	Other information: -

Fundamentals of Energy Technology					GETK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4051	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	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:	
	Graduates are able to describe and analyse the structure of electrical high-voltage systems. They are able to present and explain electrical generators and the function of the equipment in the electrical network. They can calculate energy supply systems.	
3	Contents:	
	High-voltage three-phase system High-voltage direct current transmission Design of transmission and distribution networks Power transmission and distribution equipment Synchronous generator	
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.);	
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 coordinator:	
	Prof. Dr.-Ing. Jens Haubrock	
11	Other information:	
	-	

High-Voltage Technology					HAST
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4083	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 are able to present the basics of the test and measurement technology for high-voltage tests, as well as explain and analyse the interrelationships, strength and stress of an insulating material system. Furthermore, they can explain the structure of an insulation system. With regard to both high-voltage three-phase current technology and high-voltage direct current technology, the students are able to summarise and present their knowledge.
3	Contents: • Occurrence and application of high voltages or currents • Introduction to high-voltage testing technology • Calculation of electric fields • Basics of high-voltage insulation technology • Insulating material systems in high-voltage equipment • High-voltage direct current technology
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written 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) Electrical 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 coordinator: Prof. Dr.-Ing. Jens Haubrock
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 economic interrelationships within industrial companies.
- carry out investment calculations using both simple static and dynamic methods.
- assess the relevance of key performance indicator systems for evaluating different areas of the company.
- make rational decisions to solve problems in accordance with the company's objectives.
- address essential functions and solve problems in the corporate divisions of materials management, production, sales and finances.

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 coordinator:

Prof. Dr.-Ing. Michael Fahrig

11 Other information:

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Computer Science					INFO1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4057	125 h	5	4th 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:

The students can structurally reproduce the possibilities and limitations of digital computers. They can develop simple imperative/procedural programmes. They are able to describe and apply relevant terms and methods of computer science.

3 Contents:

Contents:

- Digital computer: Structure/components, types, interfaces
- Theory and practice of imperative/procedural programming e.g. in the programming language C
- Dealing with appropriate development tools graphic aids for design, e.g. programme flow chart basic data structures and algorithms
- Finite automata and formal languages with a view to control engineering

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)

Electrical 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 coordinator:

Prof. Dr. rer. nat. Jörn Loviscach

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 in the event of questions arising in the work environment.	
4	Forms of teaching:	
	Oral examination	
5	Participation requirements:	
	Formal:	All modules of the study programme must be successfully completed. The bachelor thesis must be successfully completed.
	Content:	Treatment of the bachelor thesis
6	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 coordinator:	
	Prof. Dr.-Ing. Michael Fahrig	
11	Other information:	
	-	

Power Electronics					LEE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4064	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 are able to describe power electronic components in their function and diversity from simple dimmers in lighting and household appliances to three-phase frequency converters in three-phase applications. They have knowledge of electromagnetic compatibility (EMC) and can therefore present and explain the conditions for the interference-free interaction of micro- and power electronics in a structured manner. After successful completion of the module, the students can, taking into account the harmonics (Fourier analysis) to create power balances.
3	Contents: Functional principle of commutatorless, line-commutated and self-commutated converter circuits (W1, W3, B2, B6) Rectifier, inverter, converter and four-quadrant operation Efficiencies, harmonics (Fourier), power calculations Control, protection and cooling of power electronic components Three-phase drives with IGBT frequency converters (space vector modulation) Grid-friendly power converters with power factor control (PFC) Monolithic fusion of power electronics (energy) and microelectronics (information) on one semiconductor chip (power chips) Innovative fields of application for power electronics in automation technology, in electric vehicles and in decentralised energy management
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.);
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 coordinator: Prof. Dr.-Ing. Sebastian Hoffmann
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 it to practical applications and questions.

3 Contents:

Basic feature: 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 rules techniques, rules of de L'Hospital, curve discussion

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 coordinator:

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, spar product, vector representation of geometric relationships
Linear algebra: Calculating with matrices, matrix product, matrix representation of linear systems of equations, row normal form, Gauss-Jordan method, solvability of linear systems of 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 coordinator:

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: Dgl. 1 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 coordinator: Sabine Lüke M.Sc.
11	Other information: -

Mathematics IV					MAT4
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4055	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 have a basic understanding of Fourier series and their development and are able to apply this knowledge to technical problems. They are familiar with the Fourier transform and its advantages in application. The students know the basics of the Laplace transform and its advantages in application. In addition, they are able to solve differential equation systems with the help of the Laplace transform.	
3	Contents:	
	Fourier series Fourier transform Laplace transform	
4	Forms of teaching:	
	Self-study in the form of learning letters, classroom teaching in the form of exercises	
5	Participation requirements:	
	Formal:	-
	Content:	-
6	Forms of assessment:	
	Written examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Electrical 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 coordinator:	
	Sabine Lüke M.Sc.	
11	Other information:	
	-	

Mechatronic Systems					MESY
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4085	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 know different types of mechatronic systems such as household appliances, combine harvesters, machine aggregates, packaging machines, wood processing plants and machine tools and can describe them and describe their special features. The students are able to consistently and systematically develop complex mechatronic and automated systems themselves and to subject them to an orderly development process. They are able to fully apply the knowledge acquired during their studies to the development of mechatronic and automated systems in an everyday business environment.
3	Contents: Structure and function of mechatronic and automated systems and their special features, design guidelines for mechatronic and automated systems Modularisation of machine types and units Control types Control architecture Development of a mechatronic and automated system Planning/conception Concretisation/Modelling/Simulation Realisation/commissioning using appropriate design methods Documentation and presentation
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) Electrical 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 coordinator: N. N.
11	Other information: -

Metrology					MST
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4053	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: The students have acquired knowledge of measurands and units of measurement as well as knowledge and action competence for measuring electrical quantities and are able to classify these in the context. They can record non-electrical quantities electronically. They have skills in the assessment of dynamic processes, as well as in the overall assessment of error and accuracy. The students can create measurement reports.
3	Contents: Measured quantities and units of measurement Measurement errors in stationary systems Dynamic behaviour and model description Electrical quantities and their measurement methods Oscilloscope Digital metrology
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.);
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 coordinator: N. N.
11	Other information: -

Modern Energy Policy					MEPO
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4082	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:

After completing the module, students will be able to

- engage in a discourse on current energy policy issues and discuss them in the group.
- develop a strategic concept.
- present technical projects to the public.
- evaluate the consequences of technology politically.
- successfully manage discussions and information.

3 Contents:

Treatment of technical energy projects, e.g. e-mobility

- Wind energy projects
- Solar energy use
- Biomass and agriculture
- Water and wastewater management

Legal framework of energy policy, e.g.

- EU framework on energy efficiency
- National and EU law on the energy industry
- Structures of the energy industry and trade flows

4 Forms of teaching:

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

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Term paper

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.);

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 coordinator:

Prof. Dr.-Ing. Jens Haubrock / Dr.-Ing. Martin Stötzer

11 Other information:

Supplementary literature depending on the topic

Physics I					PH1
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4081	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 SI system and confidently transform physical quantities and units.
The students have an overview of the structure and methodology of physics and can reproduce their basic knowledge of the fundamental natural laws of mechanics.
The students can analyse and mathematically describe motion sequences of mass points and simple bodies.
The students know the elementary principles of the mechanics of stationary and moving liquids and gases and can relate these to each other.
The students have initial experience in recognising problem interrelationships and in the methods of solving technical questions and problems independently and are also able to present and explain them.

3 Contents:

Physical quantities: Notation, rules, unit systems
Basic concepts of mechanics
Kinematics: Translation and rotation
Newtonian mechanics: Mass, force, momentum, moment of inertia, torque, angular momentum
Work and energy
Conservation laws of energy, momentum, angular momentum
Laws of impact
Mechanics of liquids and gases at rest
Basic concepts of fluid mechanics

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

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.);

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 coordinator:

Prof. Dr. rer. nat. Sonja Schöning

11 Other information:

-

Physics II					PHY2
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4050	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 can analyse oscillations and waves and describe them mathematically. They know the elementary basics of thermodynamics. The students understand the essential principles of the formation and properties of imaging through ray optics. They know the terms coherence, interference and diffraction.
The students recognise problem contexts and can solve technical questions independently.
Students are familiar with the skills of simple experimentation and the presentation of measurement results. They have mastered the error analysis of measurement results and the creation of protocols for the laboratory experiments of the practical course.

3 Contents:

Oscillation and waves: Basic concepts of oscillation (harmonic oscillation, damping, forced oscillation); waves (mathematical description, standing waves, interference, refraction, diffraction, Doppler effect)
Thermodynamics: physical quantities of thermodynamics, gas laws, main theorems, real gases, circular processes
Geometrical optics (reflection and refraction, imaging with lenses)
Wave optics (interference, diffraction, polarisation)

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

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.);

9 Importance of the grade for the final grade:

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

10 Module coordinator:

Prof. Dr. rer. nat. Sonja Schöning

11 Other information:

In the practical course, the students carry out a selection of experiments from the following catalogue:
Mathematical Pendulum
Inclined Plane
Electric resonant circuit

	Calorimetry Focal length of thin lenses Dispersion at the prism

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

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 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 coordinator:	
	Prof. Dr.-Ing. Eva Schwenzfeier-Hellkamp	
11	Other information:	
	-	

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 the processing of projects.
- manage a project in a given process-organisational project organisation.
- describe the process 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 motivate oneself and teams successfully.

They understand the importance of business objectives and are able to understand 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 coordinator: 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 coordinator: Prof. Dr.-Ing. Prof. h.c. Lothar Budde	
11	Other information: -	

Control Engineering					RGT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4060	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: Students learn to comprehensively describe and analyse linear, time-invariant systems. After successful completion of the module, the students are able to analyse empirical and model-based designs of single-loop controls as well as to classify them in the technical context.
3	Contents: Basic concepts of control engineering Description and analysis of linear, time-invariant systems in the time domain and frequency domain Properties of single-loop control loops in the time and frequency domain Design of single-loop control loops using root locus and frequency characteristic methods
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.);
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 coordinator: N. N.
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 lessons,
- select and use them in a way that is appropriate to the content and the target group,
- incorporate subject-specific features of mechanical engineering and electrical engineering into didactic concepts,
- carry out a teaching sequence and to reflect on it afterwards,
- structure subject-related content in a learning field-oriented way 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 coordinator:

Prof. Dr.-Ing. Thorsten Jungmann

11 Other information:

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Technical English					TENG
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4026	125 h	5	2nd or 6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	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: The students acquire an extended active language competence at the upper B2 level. They have a sound specialist vocabulary of Technical English and can combine it with Business English terminology relevant to their profession.
- Social competence: they develop sensitivity to differences in intercultural communication, especially in English-speaking business environment.
- Methodological competence: They are able to skim specialist texts for essential information and present them shortly and concisely both in speaking and in writing. They establish wider contexts and make a critical assessment.
- Personal competence: They show English fluency and a pro-active approach to managing authentic English sources.

3 Contents:

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

4 Forms of teaching:

Seminar-based teaching / individual and group work, etc. / semester project (Assignment)

5 Participation requirements:

Formal:	Regular attendance (70%) and active participation
Content:	English language competence: B2.1 (according to the European Reference Framework for Languages)

6 Forms of assessment:

Combination examination

7 Prerequisite for the award of credit points:

Passed semester project and written exam

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

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 coordinator:

OStR Cornelia Biegler-König

11 Other information:

Literature will be announced at the beginning of the course. Textbook, additional materials, intranet self-study courses

Thermodynamics					TDY
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
4014	125 h	5	5th or 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 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 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 coordinator: Prof. Dr.-Ing. Jürgen Hermeler
11	Other information: -

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

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	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 coordinator:

Prof. Dr.-Ing. Michael Fahrig

11 Other information:

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