TECHNISCHE UNIVERSITÄT DRESDEN

Directory of Modules for Visiting Students *Diplom* Programme in Renewable Energy Systems

Faculty of Electrical and Computer Engineering

Information Package for International Visiting and Exchange Students

October 2024, **valid as of winter semester 2025/26**

FAKULTÄT **ELEKTROTECHNIK** UND **INFORMATIONSTECHNIK**

Description

The Faculty of Electrical and Computer Engineering and the Faculty of Mechanical Science and Engineering at the Technische Universität Dresden offer the **Diplom degree programme in Renewable Energy Systems.** This programme is an integrated five-year (single-tier) programme and thus **includes Bachelor as well as Master's level.**

Structure

The degree programme in Renewable Energy Systems is divided into **basic studies and main studies**.
The **basic studies** include **semester 1-4** (= first and second year of the programme);
the **main studies** include **semester 5-10** (= third until fifth year of the programme).

The programme **comes in modules**. Each module **consists of 1, 2, 3 or 4 parts, i.e. courses**.
Mostly the course name is equivalent to the module name but sometimes it differs.

You must visit all parts/courses of one module!
Also, you have to choose minimum 70% of the modules offered by the Faculty of Electrical and Computer Engineering!

Language of instruction

The study programme is held in **German**. Students who apply for this study programme should have **German language skills** of at least **B1**.

Specialization areas

Within the **main studies,** there are modules of the following **specialization areas** to choose from:

- Solar energy / Solar
- Geothermal energy / Geothermie
- Wind/Water / Wind/Wasser
- Biomass / Biomasse
- Networks / Netze
- H2 / Wasserstoff
- Energy efficiency / Energieeffizienz

In order to avoid timetable conflicts you should choose from one spezialisation area!

Content of the following module catalogue

1. **Overview of the basic studies modules**, 1st-4th semester, Bachelor level
2. **Overview of the main studies modules**, 5th-10th semester, all specializations
3. **Module descriptions of the basic studies modules**
4. **Module descriptions of the main studies modules**

FAQ

The FAQ shall answer any questions about the module catalogue.

Why is it called modules but not courses?

Each module consists of 1,2, 3 or 4 parts, i.e. courses. Mostly, if it is just one part, the course name is equivalent to the module name.

In which semester are the modules offered?

Please look in the columns “winter semester” / “summer semester”.
The academic year at the TU Dresden is divided into the winter semester (October–March) and summer semester (April–September). The semester dates for the following academic years can be found here.
Our module descriptions inform you in which semester, i.e. winter or summer semester, the respective module is offered. When setting up your learning agreement it is important to consider at first which semester you are coming to the TU Dresden (either the winter or summer semester) and then choose appropriate modules.

What level does the module have?

Please look in the columns “1st semester”, “2nd semester” etc. to find out the semester when it is held. Basic studies are from 1st-4th semester; main studies from 5th-10th semester.

Why are the 7th and 10th semester not indicated?

During the 7th our students conduct a traineeship in companies. In the 10th they write their final thesis.
That is why you see the columns for the 5th, 6th, 8th, 9th semester only.
The **8th** is in **summer semester** and the **9th in winter semester**.
Some modules take two semesters and start in the 8th semester, i.e. summer semester.

Please make sure that you visit the whole module!

How long is an “hour per week”?

An hour per week (German: SWS =Semesterwochenstunde) is one lesson of 45 minutes per week during the teaching period.
At the TU Dresden, **lessons** usually last for **90 minutes**, i.e. one double lesson
(German: Doppelstunde (DS).
1 double lesson (Doppelstunde) = 2 hours per week (Semesterwochenstunde)

What does L/T/P mean?

- L means lecture
- E means exercises
- P means practical lab course

What does 2/2/0 or 4/4/1 mean?

The **first number** stands for the hours per week for the **lecture**.
The **second number** stands for the hours per week for the **exercise**.
The **third number** stands for the hours per week for the **practical lab course**.

Examples:
2/2/0 = 2 hours per week lectures (90 minutes lecture every week), 2 hours per week exercises (90 minutes exercises every week), no practical lab course

4/1/1 = 4 hours per week lectures (180 minutes lecture every week), 1 hour (45 minutes) per week exercises but mostly conducted as 90 minutes every other week, 1 hour (45 minutes) per week practical lab course but conducted as 90 minutes every other week or as block course.

What does "PL" mean"?

It is German for Prüfungsleistung which means assessment.

I have chosen a module – what to do next?

After you have chosen a module you should know which parts are included in the module, in which semester the parts take place, and if a lecture, exercises and/or practical lab course is included. Furthermore you should search for it in the timetables.

Detailed information you can find on the websites Plan your Studies as well as
Create your timetable.

Note: The English version of our module descriptions is not legally binding.

Overview of the
Basic studies modules 1st-4th semester
(Bachelor level)

Module number, with link to description	**Module name** English German	**1st semester winter semester** L/T/P	**2nd semester summer semester** L/T/P	**3rd semester winter semester** L/T/P	**4th semester summer semester** L/T/P	**Language of instruction**	**ECTS Credits**
EuI-RES-C-GET	Basics of Electrical Engineering Grundlagen der Elektrotechnik	2/2/0 PL				German	**5**
EuI-RES-C-Ma1	Introduction to Analysis and Algebra Algebraische und analytische Grundlagen	6/4/0 PL				German	**11**
EuI-RES-C-SwEgG	Software Engineering Basics Software Engineering Grundlagen	2/1/1 2 PL				German	**5**
EuI-RES-C-Wrkst	Materials Science Werkstoffe	2/1/0 PL				German	**3**
EuI-RES-C-Ph	Physics Physik	2/2/0				German	**5**
EuI-RES-C-EMF	Electric and Magnetic Fields Elektrische und magnetische Felder		2/2/0 PL			German	**5**
EuI-RES-C-Ma2	Calculus for Functions with Several Variables Mehrdimensionale Differential- und Integralrechnung		4/4/0 PL			German	**9**
EuI-RES-C-TM	Engineering Mechanics Technische Mechanik		2/2/0 PL			German	**5**
EuI-RES-C-GE	Electronic Systems Design Geräteentwicklung		2/2/0 PL			German	**5**
EuI-RES-C-EnWi	Introduction to Energy Management Einführung in die Energiewirtschaft		2/2/0 PL			German	**5**
EuI-RES-C-DNW	Dynamical Electrical Networks Dynamische Netzwerke			2/2/0 PL		German	**5**

EuI-RES-C-Ma3	Complex Function Theory Funktionentheorie			2/2/0 PL		German	**5**
EuI-RES-C-PrET	Practice Electrical Engineering Praktische Elektrotechnik			0/0/1	0/0/1 PL	German	**2** **(1+1)**
EuI-RES-C-EET	Electrical Power Engineering Elektroenergietechnik			3/1/0 PL	0/0/1 PL	German	**5**
EuI-RES-C-KIN	Fundamentals of Kinematics and Kinetics Grundlagen der Kinematik und Kinetik			2/2/0 PL		German	**5**
EuI-RES-C-Konst	Design Methodologies Konstruktion			2/2/0 PL		German	**5**
EuI-RES-C-FeTe	Manufacturing Engineering Fertigungstechnik			2/1/0 PL		German	**3**
EuI-RES-C-GLTD	Thermodynamics Basics Grundlagen der Thermodynamik			2/2/0 1 hour per week tutorial PL		German	**5**
EuI-RES-C-Ma4	Partial Differential Equations and Probability Theory Partielle Differentialgleichungen und Wahrscheinlichkeitstheorie				2/2/0 PL	German	**5**
EuI-RES-C-GStM	Fundamentals of Fluid Mechanics Grundlagen der Strömungsmechanik				2/2/0 PL	German	**5**
EuI-RES-C-WÜ	Heat Exchange Wärmeübertragung				2/2/0 PL	German	**5**
EuI-RES-C-RESG	Renewable Energy Systems Basics Regenerative Energiesysteme Grundlagen				2/1/0 1 hour per week seminars PL	German	**5**
EuI-RES-C-ESysT	Introduction to System Theory Einführung in die Systemtheorie				2/2/0 PL	German	**5**

Overview of the
Main studies modules 5th-10th semester
(relevant for all specialization areas)

Module number, with link to description	**Module name** English German	**5th semester** **winter semester** L/T/P	**6th semester** **summer semester** L/T/P	**Language of instruction**	**ECTS Credits**
RES-H01	Specifics of Renewable Energy Systems Vertiefung Regenerativer Energiesysteme		2/2/1 2 PL	German	**6**
RES-H02	Fundamentals of Electrical Power Systems Grundlagen elektrischer Energieversorgungs-systeme	3/2/0 2 PL		German	**5**
RES-H03	Introduction to Energy Economics and Manage-ment BWL/Einführung in die Energiewirtschaft		2/0/0 PL	German	**3**
RES-H04	High Voltage and High Current Engineering Hochspannungs- und Hochstromtechnik	2/1/1 2 PL		German	**5**
RES-H05	Power Electronics Leistungselektronik	2/1/1 2 PL		German	**4**
RES-H06	Electrical Machines Elektrische Maschinen	3/1/0 PL	0/0/1 PL	German	**5**
RES-H07	Control of Continuous Time Processes Regelungstechnik	3/1/0 PL	0/0/1 PL	German	**5**
RES-H08	Measurement and Sensor Techniques Mess- und Sensortechnik	2/0/1 2 PL		German	**4**
RES-H09	Thermodynamics of Processes Prozessthermodynamik	2/2/0 PL		German	**4**
RES-H10	Principles of Fluid Flow Machinery Grundlagen der Fluidenergiemaschinen		4/1/0 2 PL	German	**5**

Overview of the
Main studies modules 5th-10th semester
(Core Modules)

Module number, with link to description	**Module name** English German	**8th semester summer semester** L/T/P	**9th semester winter semester** L/T/P	**Language of instruction**	**ECTS Credits**
RES-WK-02 **(Solar energy; Wind/Water)**	Power Electronics for Photovoltaics and Wind Energy Plants Leistungselektronik für Photovoltaik-und Windenergieanlagen	3/2/1 2 PL		German	**7**
RES-WK-03 **(Solar energy)**	Solar Heat Solarthermie		4/1/1 2 PL	German	**7**
RES-WK-04 **(Geothermal energy)**	Geology and Exploration of Natural Energy Resources Geologie und Erschließung	4/2/0 PL		German	**7**
RES-WK-05 **(Geothermal energy)**	Processes and Machines for Low-Temperature and Waste Heat Utilization Prozesse und Maschinen zur Niedertem-peratur- und Abwärmenutzung		4/2/1 3 PL	German	**7**
RES-WK-06 **(Wind/Water)**	Introduction to Numerical Solid and Fluid Mechanics Einführung in die numerische Festkörper- und Fluidmechanik		3/2/1 2 PL	German	**7**
RES-WK-07 **(Wind/Water)**	Lightweight Components of Wind Turbines Leichtbau-Komponenten von Windenergie-anlagen		4/2/0 2 PL	German	**7**
RES-WK-08 **(Wind/Water)**	Calculation of Wind Turbines Berechnung Windenergieanlagen	2/1/0 PL	2/1/0 PL	German	**7**
RES-WK-09 **(Geothermal energy; Wind/Water; Biomass)**	Electromagnetic Energy Conversion Elektromagnetische Energiewandler	4/1/1 2 PL		German	**7**

RES-WK-10 **(Biomass)**	Biomass Sources Biomassebereitstellung	4/1/1 2 PL		German	**7**
RES-WK-11 **(Biomass)**	Biomass for Energy Energetische Biomassenutzung		4/1/2 2 PL	German	**7**
RES-WK-12 **(H2)**	Fuel Cells Brennstoffzellen		4/2/0 PL	German	**7**
RES-WK-13 **(Energy efficiency)**	Electric Drives Elektrische Antriebe	3/1/1 2 PL		German	**7**
RES-WK-21 **(Solar energy; Geothermal energy; Wind/Water; Biomass, Networks; H2; Energy eff.)**	Fundamentals of Energy Storage Grundlagen der Energiespeicherung	4/2/0 2 PL		German	**7**
RES-WK-22 **(Wind/Water)**	Dam Engineering and Hydroelectric Power Engineering Stau- und Wasserkraftanlagen	2/1/0 2 PL	2/1/0 PL	German	**7**
RES-WK-24 **(Wind/Water)**	Chemical Thermodynamics Chemische Thermodynamik		2/2/1 PL	German	**7**
RES-WK-31 **(Solar energy; Geothermal energy; Wind/Water; Biomass, Networks; H2; Energy eff.)**	Network Integration, System Performance and Quality of Supply Netzintegration, Systemverhalten und Versorgungsqualität	3/2/1 3 PL		German	**7**
RES-WK-32 **(Solar energy; Geothermal energy; Biomass, Networks; H2; Energy efficiency)**	Heat Supply Wärmeversorgung		4/1/1 PL	German	**7**
RES-WK-33 **(H2)**	Hydrogen Technologies Wasserstofftechnik		4/2/0 2 PL	German	**7**
RES-WK-41 **(Solar energy; Geothermal energy; Biomass, Networks; H2; Energy efficiency)**	Demand Response Lastmanagement		3/3/0 PL	German	**7**

RES-WK-42 **(Solar energy; Geothermal energy; Wind/Water; Biomass, Networks; H2; Energy efficiency)**	Project Management Projektmanagement	4/2/0 2 PL		German	**7**
RES-WK-43 **(Energy efficiency)**	Process Simulation and Operation Prozessführungssysteme	1/1/0 PL	2/2/0 2 PL	German	**7**
RES-WK-44 **(Energy efficiency)**	Controlled Power Systems Geregelte Energiesysteme		4/1/1 2 PL	German	**7**
RES-WK-46 **(Energy efficiency)**	Energy efficiency, Energy management and Energy Economics Energieeffizienz, Energiemanagement und Energiewirtschaft		4/2/0 2 PL	German	**7**
RES-WK-48 **(Energy efficiency)**	Fundamentals of Refrigeration, Air Conditioning Technology and Heat Pumps Grundlagen der Kälte-, Klimatechnik und Wärmepumpen	4/1/1 2 PL		German	**7**
RES-WK-51 **(Energy efficiency)**	Introduction to Landscape and Spatial Planning and Environmental Law Einführung in die Landschafts- und Raum-planung sowie das Umweltrecht		4/2/0 2 PL	German	**7**

Overview of the
Main studies modules 5th-10th semester
(Complimental Modules)

Module number, with link to description	**Module name** English German	**8th semester** **summer semester** L/T/P	**9th semester** **winter semester** L/T/P	**Language of instruction**	**ECTS Credits**
RES-WE-01	Particle Technology for Renewable Energy Systems Partikeltechnologie für RES	3/1/1 3 PL		German	**7**
RES-WE-02	Electromagnetic Compatibility Elektromagnetische Verträglichkeit	3/0/2 2 PL		German	**7**
RES-WE-03	Protection and Control of Electrical Power Systems Schutz- und Leittechnik in elektrischen Energie-versorgungssystemen		3/2/1 3 PL	German	**7**
RES-WE-04	Planning of Electrical Power Systems Planung elektrischer Energieversorgungssysteme	4/3/0 3 PL		German	**7**
RES-WE-05	Specialization High Voltage Engineering Vertiefung Hochspannungstechnik	5/0/1 2 PL		German	**7**
RES-WE-06	Stress of Electrical Equipment Beanspruchung elektrischer Betriebsmittel		3/1/2 3 PL	German	**7**
RES-WE-07	Microprocessor Control in Power Electronics Mikroprozessorsteuerung in der Leistungselektronik	2/1/2 2 PL		German	**7**
RES-WE-09	Design of Power Electronic Systems Entwurf leistungselektronischer Systeme		4/2/0 2 PL	German	**7**
RES-WE-11	Autonomous Microsystems Autonome Mikrosysteme	6/0/0 3 PL		German	**7**
RES-WE-13	Selected Topics of Electrical Power Engineering Ausgewählte Kapitel der Elektrischen Energie-technik	2/1/0	2/1/0 PL	German	**7**

RES-WE-14	CommunicationTechnology for Thermal and Electrical Power Engineering Kommunikationstechnik in der thermischen und elektrischen Energietechnik		4/1/0 PL	German	**7**
RES-WE-15	Innovative Applications of Energy Storage Systems Methoden und Systemkonzepte für innovative Energiespeicheanwendungen		4/2/0 PL	German	**7**
RES-WE-16	Experimental High Voltage Engineering Experimentelle Hochspannungstechnik		4/0/2 2 PL	German	**7**
RES-WE-17	Optical Process Measurement Optische Prozessmesstechnik	2/0/0	2/0/2 2 PL	German	**7**

Module descriptions
Basic studies modules 1st-4th semester
(Bachelor level)

Module name	**Basics of Electrical Engineering**
Module number	EuI-RES-C-GET (EuI-BMT-C-GET, EuI-ET-C-GET, EuI-IST-C-GET, EuI-MT-C-GET)
Lecturer in charge	Prof. Dr. phil. nat. habil. Ronald Tetzlaff ronald.tetzlaff@tu-dresden.de
Objectives	After completing the module, students have basic knowledge of electrical engineering and electronics and have mastered methods for solving electrical engineering problems as a basis for further modules. The focus is on resistive circuits. They are able to describe linear and non-linear two-pole circuits and take into account the temperature dependence of their parameters, systematically analyze electrical circuits with direct current and apply special simplified analysis methods such as two-pole theory and the superposition theorem. They can calculate the power conversion in circuits and analyze and measure thermal arrangements.
Contents	The content of the module is the calculation of electrical networks with direct current.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	Knowledge of mathematics and physics at basic A-level is required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Information Systems Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 150 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Introduction to Analysis and Algebra**
Module number	EuI-RES-C-Ma1 (EuI-BMT-C-Ma1, EuI-ET-C-Ma1, EuI-IST-C-Ma1, EuI-MT-C-Ma1)
Lecturer in charge	Prof. PD Dr. Sebastian Franz sebastian.franz@tu-dresden.de
Objectives	After completing the module, students have basic mathematical knowledge and knowledge of algebra. They are able to calculate with real and complex numbers and apply functions, sequences, series, vectors, vector spaces, determinants and matrices.
Contents	The contents of the module are set theory, real and complex numbers, number sequences, series, analysis of real functions of one variable, linear spaces and mappings, matrices, determinants, linear sliding systems, eigenvalues and eigenvectors.
Modes of teaching and learning	6 hours per week lectures, 4 hours per week exercises and self-study.
Prerequisites	Knowledge of mathematics at basic A-level is required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Information Systems Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 180 minutes.
Credit points and grades	11 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 330 hours.
Duration	The module takes one semester.

Module name	**Software Engineering Basics**
Module number	EuI-RES-C-SwEgG (EuI-BMT-C-SwEgG, EuI-ET-C-SwEgG, EuI-MT-C-SwEgG)
Lecturer in charge	Prof. Dr.-Ing. Dr. h. c. Frank H.P. Fitzek frank.fitzek@tu-dresden.de
Objectives	After completing the module, students have competencies and practical skills in dealing with various programming languages and programming environments.
Contents	The module focuses on the structure and programming of computers with Python and assembler. This includes information representation, basic Boolean circuits, computer architecture, algorithms and their complexity analysis, i.e. Big O notation.
Modes of teaching and learning	2 hours per week lectures, 1 hour per week exercises, 1 hour per week practical lab course and self-study.
Prerequisites	Knowledge of mathematics at basic A-level is required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes and a complex exam of 60 hours.
Credit points and grades	5 credit points can be earned by the module. The module grade is the weighted mean of the grades of the assessments. The written exam is weighted by 1/3 and the complex exam 2/3.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Materials Science**
Module number	EuI-RES-C-Wrkst (EuI-BMT-C-Wrkst, EuI-ET-C-Wrkst, EuI-MT-C-Wrkst)
Lecturer in charge	Dr.-Ing. Stefan Enghardt stefan.enghardt@tu-dresden.de
Objectives	After completing the module, students will be able to establish a connection between the microscopic structure, the macroscopic properties and the practical application aspects of the materials. They know the theoretical basics of atomic structure, types of bonding, crystal structure, real structure and microstructure and have knowledge of materials testing.
Contents	The module covers the following areas: Overview of materials and practical examples, fundamentals of materials science, state diagrams and alloys, conductor, semiconductor, dielectric and magnetic materials as well as materials testing and diagnostics.
Modes of teaching and learning	2 hours per week lectures, 1 hour per week exercises and self-study.
Prerequisites	Knowledge of mathematics and physics at basic A-level is required. The following literature, for example, can also be used for preparation: - Elemente der Mathematik SII, Westermann Verlag, - Lambacher Schweizer Mathematik Oberstufe, Klett Verlag, - Bigalke/Köhler Mathematik, Cornelsen Verlag, - Lehrbuch Physik Gymnasiale Oberstufe, Duden Verlag, - Metzler Physik SII, Westermann Verlag, - Dorn/Bader Physik SII, Westermann Verlag.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 90 minutes.
Credit points and grades	3 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 90 hours.
Duration	The module takes one semester.

Module name	**Physics**
Module number	EuI-RES-C-Ph (EuI-MT-C-Ph)
Lecturer in charge	PD Dr. Eduard Lavrov eduard.lavrov@tu-dresden.de
Objectives	After completing the module, students will have knowledge of areas of physics as a prerequisite for understanding physical phenomena and their application in electrical engineering. With the thinking and working methods of physics, they are able to find solutions to physical problems independently.
Contents	The module covers the fields of thermodynamics, optics and structure of matter.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	Knowledge of physics at basic A-level is required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 90 minutes. A bonus to the written exam is the completion of 15 hours of exercise.
Credit points and grades	5 credit points can be earned by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Electric and Magnetic Fields**
Module number	EuI-RES-C-EMF (EuI-BMT-C-EMF, EuI-ET-C-EMF, EuI-IST-C-EMF, EuI-MT-C-EMF)
Lecturer in charge	Prof. Dr. phil. nat. habil. Ronald Tetzlaff ronald.tetzlaff@tu-dresden.de
Objectives	After completing the module, students know the basic concepts, quantities and methods for calculating simple electric fields and magnetic fields. They are able to calculate the energy stored in the field, the force effects caused by the fields and the induction effects in the magnetic field. Students are familiar with the basic principles of the electronic components resistor, capacitor, coil and transformer and their descriptive equations.
Contents	The module covers the calculation of simple electric fields and magnetic fields.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the modules **Introduction to Analysis and Algebra** and **Basics of Electrical Engineering** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Information Systems Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 150 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Calculus for Functions with Several Variables**
Module number	EuI-RES-C-Ma2 (EuI-BMT-C-Ma2, EuI-ET-C-Ma2, EuI-IST-C-Ma2, EuI-MT-C-Ma2)
Lecturer in charge	Prof. PD Dr. Sebastian Franz sebastian.franz@tu-dresden.de
Objectives	After completing the module, students have knowledge of differentiation and integration of functions with one and several variables, analytical solutions of differential equations and systems of differential equations as well as vector analysis.
Contents	The contents of the module are analysis of real functions of several variables, vector analysis, function series, differential equations and Taylor series.
Modes of teaching and learning	4 hours per week lectures, 4 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the modules **Introduction to Analysis and Algebra** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Information Systems Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 150 minutes.
Credit points and grades	9 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 270 hours.
Duration	The module takes one semester.

Module name	**Engineering Mechanics**
Module number	EuI-RES-C-TM (EuI-BMT-C-TM, EuI-ET-E-TM, EuI-MT-C-TM)
Lecturer in charge	Prof. Dr.-Ing. habil. Thomas Wallmersperger thomas.wallmersperger@tu-dresden.de
Objectives	After completing the module, students will have knowledge of the basic laws of statics and the simplified relationships between loads, material properties and stresses on components. They will have mastered the relevant calculation methods for dimensioning and strength assessment.
Contents	Contents of the module are rigid bodies, independent loads, force and moment, principle of section, balances of forces and moments of plane structures, tensile, compressive and shear stresses including elementary dimensioning concepts as well as torsion of beams with circular cross-sections, straight bending of prismatic beams, strength hypotheses and beam buckling.
Modes of teaching and learning	2 hours per week lectures, two hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra** are required. Further, knowledge of of mathematics and physics at basic A-level is required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Biomedical Engineering, Mechatronics and Renewable Energy Systems. Further, it is one of two compulsory elective modules in the field of Electrical Power Engineering in the degree programme Electrical Engineering, of which one must be selected. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Electronic Systems Design**
Module number	EuI-RES-C-GE (EuI-BMT-C-GE, EuI-ET-C-GE, EuI-MT-C-GE)
Lecturer in charge	Prof. Dr.-Ing. habil. Jens Lienig jens.lienig@tu-dresden.de
Objectives	After completing the module, students will have acquired basic knowledge of the design and development of electronic assemblies and devices. They will have an understanding of engineering tasks and the various requirements to be taken into account. As a result, students are able to take an engineering approach to the development and design of these products, taking into account all relevant aspects.
Contents	The module covers design fundamentals such as technical representation, circuit diagram creation and CAD, as well as focusing on device design and device requirements, reliability of electronic devices, thermal dimensioning and electromagnetic compatibility (EMC).
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	There are no special prerequisites.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Introduction to Energy Management**
Module number	EuI-RES-C-EnWi (EuI-ET-E-EnWi, EuI-MT-E-EnWi)
Lecturer in charge	Prof. Dr. habil. D. Möst dominik.moest@tu-dresden.de
Objectives	After completion of the module, the students master the methods of investment appraisal, can evaluate investment projects with regard to their economic advantage and make well-founded decisions. Students can analyze and evaluate different energy sources, such as coal, gas, oil, electricity, heat as well as their characteristics, including reserves, suppliers, costs and technologies. Students are familiar with the energy policy framework. They are able to understand energy-economic interrelationships and to evaluate the economic and ecological effects of energy supply.
Contents	The contents of the module are methods of investment calculation, calculation of electricity production costs and energy supply costs, evaluation of the overall energy system, the importance of individual energy sources, energy supply and demand as well as energy sources such as gas, coal, oil, secondary energy sources electricity and hydrogen and energy policy.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	There are no special prerequisites.
Usability	The module is a compulsory module in the basic studies of the degree programme Renewable Energy Systems. Further, it is a compulsory elective module from the compulsory elective area General Qualifications according to § 6 paragraph 3 SO and § 33 paragraph 3 PO of the main study programme in the diploma study programme Mechatronics. It is also a compulsory elective module from the compulsory elective area of General Qualifications according to § 6 paragraph 3 SO and § 33 paragraph 5 PO of the main study programme in the Diploma programme in Electrical Engineering. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 90 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.

Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Dynamical Electrical Networks**
Module number	EuI-RES-C-DNW (EuI-BMT-C-DNW, EuI-ET-C-DNW, EuI-IST-C-DNW, EuI-MT-C-DNW)
Lecturer in charge	Prof. Dr. phil. nat. habil. Ronald Tetzlaff ronald.tetzlaff@tu-dresden.de
Objectives	After completing the module, students will know methods for analyzing linear dynamic circuits when excited with periodic signals or in the transition behavior of stationary states. They are able to describe, model and calculate linear two-ports. They can determine the transfer function, analyze and graphically represent the behavior in the frequency range and calculate simple filters. They will know pointer representations and locus curves.
Contents	The content of the module is the calculation of linear dynamic networks.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the modules **Basics of Electrical Engineering, Calculus for Functions with Several Variables** and **Electric and Magnetic Fields** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Information Systems Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 150 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Complex Function Theory**
Module number	EuI-RES-C-Ma3 (EuI-BMT-C-Ma3, EuI-ET-C-Ma3, EuI-IST-C-Ma3, EuI-MT-C-Ma3)
Lecturer in charge	Prof. PD Dr. Sebastian Franz sebastian.franz@tu-dresden.de
Objectives	After completing the module, students have knowledge of functions with complex variables.
Contents	The content of the module is function theory with a focus on differentiability, integration and series expansion.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Calculus for Functions with Several Variables** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Information Systems Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Practice Electrical Engineering**
Module number	EuI-RES-C-PrET
Lecturer in charge	Prof. Dr. phil. nat. habil. Ronald Tetzlaff ronald.tetzlaff@tu-dresden.de
Objectives	After completing the module, students are familiar with the use of electronic measuring devices. They have extensive skills and experience in setting up and carrying out experiments, evaluating and presenting test and measurement results, assessing measurement methods and measurement uncertainties and writing protocols.
Contents	The module covers measurements on electronic circuits, including computer-controlled measurement technology.
Modes of teaching and learning	2 hours per week practical lab courses and and self-study.
Prerequisites	The skills to be acquired in the modules **Basics of Electrical Engineering, Introduction to Analysis and Algebra, Calculus for Functions with Several Variables and Electric and Magnetic Fields** are required.
Usability	The module is a compulsory module in the basic studies of the degree programme Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a complex assignment of 22 hours.
Credit points and grades	2 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every academic year beginning in the winter semester.
Workload	The total effort is 60 hours.
Duration	The module takes two semesters.

Module name	**Electrical Power Engineering**
Module number	EuI-RES-C-EET (EuI-ET-C-EET, EuI-MT-C-EET)
Lecturer in charge	Prof. Dr.-Ing. habil. Jan Meyer jan.meyer@tu-dresden.de
Objectives	After completing the module, students will be able to carry out basic calculations and measurements for simple three-phase systems. They are familiar with the principles of protective measures in electrical networks. They will be able to calculate simple insulation arrangements. They are familiar with the basic functions of power electronic circuits, electrical machines and three-phase transformers.
Contents	The module covers the generation, conversion, transportation, distribution and application of electrical energy, the structure of electrical energy supply, the fundamentals of three-phase technology and its mathematical description, electrical safety and the coordination of stress and strength as well as the fundamentals of power electronics and electromechanical energy converters.
Modes of teaching and learning	3 hours per week lectures, 1 hour per week exercises, 1 hour per week practical lab courses and self-study.
Prerequisites	The skills to be acquired in the modules **Basics of Electrical Engineering** and **Physics** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 150 minutes and a complex assignment of 15 hours. Both written exam as well as complex assignment have to be passed.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the weighted mean of the grades of the assessments. The written exam is weighted by 1/3 and the complex assignment 2/3.
Frequency	The module is offered every academic year beginning in the winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes two semesters.

Module name	**Fundamentals of Kinematics and Kinetics**
Module number	EuI-RES-C-KIN (EuI-MT-C-KIN)
Lecturer in charge	Prof. Dr.-Ing. habil. Thomas Wallmersperger Thomas.Wallmersperger@tu-dresden.de
Objectives	After completing the module, students will know analytical methods for analyzing rigid body movements, including the loads that cause them.
Contents	The contents of the module are kinematics of the point and the rigid body, kinetics of the rigid body in translation, kinetics of the rigid body in arbitrary motion, momentum and angular momentum balance including the intersection principle, static interpretation of momentum balances, free planar motion, oscillations of systems with different degrees of freedom, impact processes, Lagrangian equations of the second kind and spatial rotor motion.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables** and **Engineering Mechanics** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Design Methodologies**
Module number	EuI-RES-C-Konst (EuI-MT-C-Konst)
Lecturer in charge	Prof. Dr.-Ing. Berthold Schlecht berthold.schlecht@tu-dresden.de
Objectives	After completing the module, students will be familiar with the mechanical engineering fundamentals for the work of a mechanical engineer in development, design, research, production, quality assurance, testing and planning. They will be able to apply the basics of calculating the load-bearing capacity of simple components such as axles and shafts, shaft-hub connections, rolling bearings and gear drives. They will be able to assess the suitability of typical machine elements for use in all specialist areas, select them, design them in combination and calculate them using modern tools.
Contents	The contents of the module are the function and structure of individual machine elements as well as generally valid basic knowledge for their calculation and design, in particular the basics of the corresponding methods for dimensioning or recalculation of components or assemblies, for example shafts and axles, rolling bearings and gear drives, taking into account the modern state of the art.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables, Physics, Basics of Electrical Engineering, Materials Science**, **Engineering Mechanics** and **Electronic Systems Design** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 180 minutes and a term paper of 30 hours. The written exam has to be passed.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the weighted mean of the grades of the assessments. The written exam is weighted by 4/5 and the complex assignment 1/5.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Manufacturing Engineering**
Module number	EuI-RES-C-FeTe (EuI-MT-C-FeTe)
Lecturer in charge	Prof. Dr.-Ing. H. C. Hans Christian Schmale hans_christian.schmale@tu-dresden.de
Objectives	After completing the module, students will know which areas of a company are involved in the manufacture of products, which product requirements determine the manufacturing options and how manufacturing decisions are derived. They know the manufacturing processes, in particular their operating principles, the technical equipment and the technological parameters to be defined. Students have essential basic knowledge relating to the manufacture of products in mechanical, vehicle and plant engineering and understand the basic engineering approach as a basis for later independent work to derive technological decisions in relation to product design, material properties and equipment functionality. Students are able to select suitable processes and determine their most important process parameters.
Contents	The module deals with the variety of manufacturing processes in mechanical engineering, vehicle and plant construction using product and process examples. It integrates the thinking and working methods of engineers in production as well as the interaction with other specialist disciplines. The module covers the manufacturing and production engineering fundamentals for the manufacture of products and the process chains that can be designed for this purpose. The focus is on the most important manufacturing processes of primary forming, forming, machining, removal, joining and surface technology, their operating principles and process parameters.
Modes of teaching and learning	2 hours per week lectures, 1 hour per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables, Physics, Materials Science**, **Engineering Mechanics** and **Electronic Systems Design** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 90 minutes.

Credit points and grades	3 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 90 hours.
Duration	The module takes one semester.

Module name	**Thermodynamics Basics**
Module number	EuI-RES-C-GLTD
Lecturer in charge	Prof. Cornelia Breitkopf cornelia.breitkopf@tu-dresden.de
Objectives	After completing the module, students will be familiar with the thermodynamic vocabulary, understand the definitions of thermodynamic systems and elementary thermodynamic variables and are able to formulate practical problems using the basic thermodynamic variables. They understand thermodynamic state variables and can calculate them using various equations of state. They know the model assumptions of the equations of state. Students understand the concepts of processes and process variables, thermodynamic systems and changes of state and are able to thermodynamically assess energy conversions in technical processes. Students can make this assessment on the basis of a system abstraction by combining characteristic tools of thermodynamics such as balancing, equation of state and material models. Furthermore, they are able to apply the first and second laws of thermodynamics to various technical problems. In particular, they will be able to evaluate the efficiency of different process controls and independently apply both the first and second laws of thermodynamics to thermodynamic processes. Students are familiar with practical examples and can identify, understand and analyze thermodynamic issues for ideal and real processes in practice. Students are able to deal with topics relating to the sustainability of energy conversion processes from an economic, ecological, social and gender perspective.
Contents	The module covers basic knowledge of the properties of thermodynamic systems; state variables, such as thermal and caloric state variables; process variables work and heat; changes of state, such as isochoric, isobaric, isothermal, isentropic, polytropic. Further content includes applications to ideal gases, gas mixtures, real gases and pure real substances. Furthermore, mass, energy and entropy balances are discussed as 1st and 2nd law and the exergy concept is introduced. Ideal and real processes are dealt with using selected examples. Simple right-hand and left-hand circular processes with practical relevance are presented. The three pillars of sustainability are discussed.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises, 1 hour per week tutorials and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra** and **Physics** are required.

Usability	The module is a compulsory module in the basic studies of the degree programme Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes. A bonus to the written exam is the completion of 20 hours of e-Assessments.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Partial Differential Equations and Probability Theory**
Module number	EuI-RES-C-Ma4 (EuI-BMT-C-Ma4, EuI-ET-C-Ma4, EuI-IST-C-Ma4, EuI-MT-C-Ma4)
Lecturer in charge	Prof. PD Dr. Sebastian Franz sebastian.franz@tu-dresden.de
Objectives	After completing the module, students will have knowledge of special analytical methods for solving partial differential equations and probability theory.
Contents	The module focuses on partial differential equations and probability theory.
Modes of teaching and learning	4 hours per week lectures, 4 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Complex Function Theory** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Electrical Engineering, Biomedical Engineering, Information Systems Engineering, Mechatronics and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Fundamentals of Fluid Mechanics**
Module number	EuI-RES-C-GStM
Lecturer in charge	Prof. Dr.-Ing. habil. J. Fröhlich jochen.froehlich@tu-dresden.de
Objectives	After completing the module, students will have a basic understanding of the mechanics of gases and fluids. They will be able to analyze and quantitatively describe simple technical flow configurations.
Contents	The module covers the fundamentals of the mechanics of gases and fluids, conservation laws of classical mechanics in differential and integral form, one-dimensional flow filament theory for incompressible and compressible fluids including their use for technically relevant configurations as well as laminar and turbulent flows.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables** and **Physics** are required.
Usability	The module is a compulsory module in the basic studies of the degree programme Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 150 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Heat Exchange**
Module number	EuI-RES-C-WÜ
Lecturer in charge	Prof. Dr.-Ing. M. Beckmann michael.beckmann@tu-dresden.de
Objectives	After completing the module, students understand the basic mechanisms of heat transfer and can apply the associated transport equations. Students are familiar with stationary processes of heat conduction, heat transfer by convection and radiation for various problems of ideal and real processes in practice. They are able to derive solution methods for the treatment of transient heat transfer and can apply the solution methods to various problems of ideal and real processes in practice. Students are able to balance heat exchangers. They are familiar with practical examples of heat transfer and can derive, understand and analyze ideal and real processes in practice.
Contents	The contents of the module are the basic relationships for the application of the conservation laws of mass, energy and momentum in connection with the transport laws for thermal energy in conduction, convection and radiation for ideal and real processes as well as the phenomenological description of the mechanisms of heat transfer. Further focal points are stationary and transient problems of heat conduction, heat transfer on ribs, the heat transfer of multi-layered bodies such as plates, cylinders or spheres, the calculation of heat exchangers and the optimization of heat transfer processes.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables, Physics** and **Thermodynamics Basics** are required.
Usability	The module is a compulsory module in the basic studies of the degree programme Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 120 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.

Duration	The module takes one semester.

Module name	**Renewable Energy Systems Basics**
Module number	RES-C-RESG
Lecturer in charge	Prof. Dr.-Ing. Clemens Felsmann clemens.felsmann@tu-dresden.de
Objectives	After completing the module, students will have basic knowledge of potentials and technologies, including their operating principles, parameters, economic efficiency and environmental aspects for the development of renewable energy sources.
Contents	The module provides an overview of the technical and economic possibilities of using solar energy, geothermal energy, wind power, hydropower and biomass. The focus is on the use of these energy sources and technical solutions in Central Europe and their evaluation, taking into account the state of the art and the technical and economic development potential.
Modes of teaching and learning	2 hours per week lectures, 1 hour per week exercises, 1 hour per week seminars and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables, Physics, Thermodynamics Basics, Basics of Electrical Engineering, Electric and Magnetic Fields** and **Introduction to Energy Management** are required.
Usability	The module is a compulsory module in the basic studies of the degree programme Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 90 minutes. If fewer than 20 students are registered, the written exam will be replaced by a non-public oral exam of 20 minutes as a group exam; if necessary, this will be announced to the registered students at the end of the registration period in the usual manner. A bonus to the written exam is a research assignment of 15 hours.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Introduction to System Theory**
Module number	EuI-RES-C-ESysT (EuI-BMT-C-ESysT)
Lecturer in charge	Prof. Dr.-Ing. Rafael F. Schaefer rafael.schaefer@tu-dresden.de
Objectives	After completing the module, students will be familiar with the general conceptual and methodological foundations for describing dynamic processes in nature and technology. They will be able to view static and dynamic systems from a uniform system-theoretical point of view and describe and analyze them mathematically. They know the properties of continuous-time and discrete-time systems in the time and image domain and are able to apply signal transformations to effectively describe system behavior in the image domain.
Contents	The content of the module is an overview of selected fundamentals of systems theory with a focus on analog signals and systems with continuous time, analog signals and systems with discrete time, digital systems and selected applications.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The skills to be acquired in the module **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables, Complex Function Theory, Basics of Electrical Engineering** and **Dynamical Electrical Networks** are required.
Usability	The module is a compulsory module in the basic studies of the degree programmes Biomedical Engineering and Renewable Energy Systems. It creates the prerequisites for the modules that list that module in the "Prerequisites" field.
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam of 90 minutes.
Credit points and grades	5 credit points can be obtained by the module. The module grade is the grade of the examination.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module descriptions
Main studies modules 5th-10th semester
(relevant for all specialization areas)

Module number	Module name	Lecturer in charge
RES-H01	Specifics of Renewable Energy Systems	Prof. Dr.-Ing. C. Felsmann
Contents and objectives	The content of the module is the integration of renewable energy sources into higher-level energy systems. This includes general and in-depth questions of the constructive plant design, the technical-economic problems of the design, the evaluation and the operation of plants for the use of regenerative energy sources. In particular, the combination with conventional energy systems based on fossil fuels is dealt with. A further focus is on the basics of refrigeration technology, including regenerative refrigeration, and the introduction to the associated systems of refrigeration, air conditioning and heat pump technology. Qualification goals: 1. The students have knowledge of interpretation, application development and evaluation of regenerative energy systems (switching systems, plant technology and operation) 2. The students master the basics of refrigeration technology, in particular regenerative refrigeration.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, 1 hour per week practical lab courses, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G12 Fundamentals of Renewable Energy Systems and RES-G18 Fluid Mechanics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. If there are more than 10 participants, it consists of a K1 written test of 120 minutes and the practical lab course P. If there are up to 10 participants, the written test is replaced by an oral examination as a group test with up to 3 people of 20 minutes each. if applicable, this will be announced to the registered students at the end of the registration period as is customary in the faculty.	
ECTS credit points and grades	6 ECTS credit points The module grade M is calculated from the grades of the examination according to $M = 0.75 \cdot K1 + 0.25 \cdot P$.	

Frequency	Annually, in the summer semester
Workload	180 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-H02	Fundamentals of Electrical Power Systems	Prof. Dr.-Ing. P. Schegner
Contents and objectives	Contents: - Function, parameter estimation and modeling of all important equipment in electrical distribution networks - Simplified methods for the calculation of voltage and current distribution as well as the basic aspects of design and dimensioning of electrical systems Intended learning outcome: Upon successful completion of the module, students are able to create and apply models for equipment in the electrical power system. They have the skills to determine the parameters for the most important equipment from geometrical data, manufacturer's specification or with the help of measurements. The students are familiar with the basics of dimensioning of electrical equipment.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competences acquired in modules such as Basics of Electrical Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two written exams of 120 minutes and 90 minutes.	
ECTS credit points and grades	5 ECTS credit points The module grade consists to 2/3 of the grade for the exam of 120 min. and to 1/3 of the grade for the exam of 90 min.	
Frequency	Annually, in the winter semester	
Workload	150 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-H03	Introduction to Energy Economics and Management	Prof. Dr. habil. D. Möst
Contents and objectives	The student • will be able to masters the methods of investment calculation, can evaluate investment projects with regard to their economic advantages and make well-founded decisions, • can characterize and evaluate the different energy sources (coal, gas, oil, electricity, heat etc.) and their peculiarities (reserves, providers, costs, technologies), • knows the framework of energy policy and is able to understand the context of the energy industry, • is capable of ecological effects of the energy supply assessment.	
Modes of teaching and learning	2 hours per week lectures and self-study.	
Prerequisites	None.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 90 minutes.	
ECTS credit points and grades	3 ECTS credit points The module grade results from the grade of the written test.	
Frequency	Annually, in the summer semester	
Workload	90 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-H04	High Voltage and High Current Engineering	Prof. Dr.-Ing. S. Großmann
Contents and objectives	The module contains basics and principles of – High voltage engineering – High current engineering Qualification: After successful completion of the module, the students will be able to comprehend the operating behaviour of components in an electrical power supply network. Furthermore the students will be able to evaluate the stress of a component by electrical and mechanical loads by means of proper measurements and tests.	
Modes of teaching and learning	2 hours per week lectures, 1 hour per week tutorial/seminar, 1 hour per week practical lab course and self-study	
Prerequisites	Competences acquired in modules such as Basics of Electrical Engineering and Physics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessement is passed. The module examination consists of a written exam PL1 of 90 minutes and a practical lab course PL2. For up to 20 participants, the written exam is replaced by an oral exam as a group exam with up to 3 people, each lasting 30 minutes. Both exams have to be passed.	
ECTS credit points and grades	5 ECTS credit points The module consists to 70% of the oral exam grade/the written exam grade and to 30% of the lab course grade.	
Frequency	Annually, in the winter semester	
Workload	150 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-H05	Power Electronics	Prof. Dr.-Ing. St. Bernet
Contents and objectives	Content: 1. Structure and mode of operation of active power semiconductor components and power diodes, 2. analysis of the functioning of line and self-guided circuits, 3. simplification of the systems under consideration for the purpose of simulation, 4. interpretation of the core components of the power electronics subsystem, 5. modulation methods for controlling power electronic regulator control elements Objectives: The students 1. are familiar with the mode of operation and methods for the analysis of basic power electronic topologies and semiconductor components 2. are able to select and dimension appropriate circuits. Further, they are able to select and interpret power semiconductor devices for power electronic systems in typical applications. 3. are able to verify the basic function of the observed power electronic subsystem with means of simulation tools.	
Modes of teaching and learning	2 hours per week lecture, 1 hour per week tutorial, 1 project, and self-study	
Prerequisites	Competences acquired in modules such as Basics of Electrical Engineering, or equivalent.	
Usability	This module is a compulsory module within the Diplom degree programmes in Mechatronics and Renewable Energy Systems.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a project (PA, 30 Stunden) and a written exam (K, 120 min).	
ECTS credit points and grades	4 ECTS credit points The module grade M is calculated as follows: M= (4K + PA)/5	
Frequency	Annually, in the winter semester	
Workload	120 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-H06	Electrical Machines	Prof. Dr.-Ing. W. Hofmann
Contents and objectives	Content: **Fundamentals of electrical machines** in structure, function, performance, agitator speed or power setting and efficiency - Fundamentals of electromagnetic energy conversion - Transformers - DC maschines - Synchronous machines - Induction machines - Small machines - Linear motors - Testing of electrical machines Objectives: Having successfully completed the module, the students can follow the steady-state operating performance of electrical machines and evaluate their properties by means of suitable calculations, measurements and tests.	
Modes of teaching and learning	3 hours per week lectures, 1 hour per week tutorial, 1 hour per week practical lab course, and self-study	
Prerequisites	Competences acquired in modules such as Basics of Electrical Engineering and Physics, or equivalent.	
Requirements for the award of credit points	The credit points are awarded when the module assessment is passed. The module examination consists of a written exam PL1 of 180 minutes and a lab course P.	
ECTS credit points and grades	5 ECTS credit points The module grade is the weighted average of both elements of assessment. The grade of the written exam contributes by 70% and the grade of the lab course by 30%.	
Frequency	Annually, starting in the winter semester	
Workload	150 hours	
Duration of module	2 semesters	

Module number	Module name	Lecturer in charge
RES-H07	Control of Continuous-Time Processes	Prof. Dr.-Ing. habil. K. Röbenack
Contents and objectives	Content: Fundamentals of control of linear systems (basic structures of control, signal and system descriptions, stability analysis, controller design in the frequency range), fundamentals of behavioural description of discrete event systems (signal-based, finite automata, Petri nets) and for the design of discrete event control systems (bottom-up, top-down automata and Petri nets), examples of laboratory-based control systems Objectives: Having successfully completed the module, the students will be able to 1. understand the basic structure of controls. They are able to describe linear systems mathematically and to analyse these with regard to their stability. Further, they are able to design single-loop linear controllers. 2. are able to solve control problems on real technical-physical systems.	
Modes of teaching and learning	3 hours per week lectures, 1 hours per week tutorials, 1 hour per week lab courses, and self-study	
Prerequisites	Competences acquired in modules such as RES-G11 Automation Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are awarded when the module assessment is passed. The module assessment consists of a written exam (K1, 120 min.) on objective 1, a lab course (P) on objective 2.	
ECTS credit points and grades	5 ECTS credit points The module grade M is calculated as follows: $M = 0.8 \cdot K1 + 0.2 \cdot P$	
Frequency	Annually, starting in the winter semester	
Workload	150 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
RES-H08	Measurement and Sensor Techniques	Prof.Dr.rer.nat. St. Odenbach
Contents and objectives	The module includes measurement principles, methods and procedures for expansion, temperature, flow and sound and includes the necessary interpositions as well as the description of the dynamic behavior of measuring elements. The students will be able to master the basic principles and the practical implementation of measurement and sensor methods. The students are able to present and assess the physical principle and the technical design of measuring and sensor methods under real conditions. They are familiar with calculation methods for measurement uncertainty.	
Modes of teaching and learning	2 hours per week lectures, 1 hour per week lab courses, and self-study.	
Prerequisites	Competences acquired in modules such as Physics, Introduction to Analysis and Algebra, Calculus for Functions with Several Variables, Basics of Electrical Engineering, Materials, Engineering Mechanics, RES-G15 Fundamentals of Kinematics and Kinetics RES-G18 Fluid Mechanics and RES-G17 Heat Exchange, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 150 minutes and lab course P.	
ECTS credit points and grades	4 ECTS credit points The module grade results from the grades of the examinations according to the following formula: $M = 0.75 \cdot K + 0.25 \cdot P$	
Frequency	Annually, in the winter semester	
Workload	120 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-H09	Thermodynamics of Processes	Prof. Dr. rer. nat. habil. C. Breitkopf
Contents and objectives	This module contains the basics of thermodynamic cycle processes and technical combustion. The students will be able to master the calculation of relevant systems in energy technology and know basic processes in gas turbine, steam and heating power plants and refrigeration machines. He is able to calculate and evaluate specific plant circuits and to be able to classify them in terms of the overall energy economy.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competences acquired in modules such as Introduction to Analysis and Algebra, Calculus for Functions with Several Variables, Physics and RES-G16 Technical Thermodynamics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 150 minutes.	
ECTS credit points and grades	4 ECTS credit points The module grade results from the grade of the written exam.	
Frequency	Annually, in the winter semester	
Workload	150 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-H10	Principles of Fluid Flow Machinery	Prof. Dr.-Ing. U. Gampe
Contents and objectives	The module covers the basics of turbo and piston machines. This applies to the types and areas of application of these machines, the basics of energy conversion, design, construction and operating behavior. The students will master the selection of suitable fluid energy machines for specified operating conditions and operating parameters. This includes the type and number of stages, the determination of the main dimensions, the rough design of the most important functional elements and the consideration of energy conversion losses as well as the interaction of the energy machine and system. The student will be able to solve typical engineering tasks that are typically interdisciplinary due to their thermodynamic, fluid, structural and material-technical aspects.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorials, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G18 Fluid Mechanics, RES-G16 Technical Thermodynamics, Materials, Engineering Mechanics and RES-G20 Design Engineering and Manufacturing Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two written exams (K1 and K2) of 90 minutes each.	
ECTS credit points and grades	5 ECTS credit points The module grade results from the grades of the examinations according to the following formula: $M = 0.5 \cdot K1 + 0.5 \cdot K2$	
Frequency	Annually, in the summer semester	
Workload	150 hours	
Duration	1 semester	

Module descriptions
Main studies modules 5th-10th semester
(Core Modules)

Module number	Module name	Lecturer in charge
RES-WK-02	Power Electronics for Photo-voltaics and Wind Energy Plants	Prof. Dr.-Ing. St. Bernet
Contents and objectives	The module includes • structure and functionality of power semiconductor components that can be actively switched on and off • analysis of the functioning of self-guided circuits and ist core components for solar and wind energy plants (for example one phase and three phase 2L VSC, 3L NPC VSC) • design of the core components of the power electronic subsystem (output filter design) • modulation methods for controlling the power elec-tronic actuators • control and regulation procedures • safety and operational requirements. Qualification goals: It enables the selection and design of suitable circuits as well as the selection and design of the power semiconductor components for power electronic systems for operating solar generators for various applications. The students can verify the function of the system under consideration including the necessary control and / or regulation by using simulation tools.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorials, 1 hour per week lab courses and self-study including a project of 40 hours.	
Prerequisites	Competences acquired in modules such as RES-H05 Power Electronics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module examination consists of a project work PA and a written test K of 120 minutes.	
ECTS credit points and grades	7 ECTS credit points The module grade results from the grades of the examinations according to:	

	M = 2/3 · K1 + 1/3 · PA
Frequency	Annually, in the summer semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-03	Solar Heat	Prof. Dr.-Ing. Clemens Felsmann
Contents and objectives	The module contains: Structure, function as well as dimensioning and operation of solar thermal systems for heat use with a special focus on large-scale systems for solar local and process heat supply as well as structure and function of solar thermal power plants including hybrid power plant processes for solar power generation. Qualification goals: 1. The students will have skills in design, interpretation and energy management evaluation of solar thermal Large plants 2. Master the basic principles of heat and electricity supply in solar thermal power plants.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorials, 1 hours per week lab courses and self-study.	
Prerequisites	Competences acquired in modules such as RES-G12 Fundamentals of Renewable Energy Systems, RES-G16 Technical Thermodynamics, RES-H09 Thermodynamics of Processes and RES-WK-01 Conversion of Solar Radiation, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module examination consists of two graded examinations and an ungraded laboratory course: With more than 20 participants, the examinations consist of a written exam PL1 for qualification goal 1 and PL2 for qualification goal 2, each lasting 120 minutes. In the case of up to 20 participants, the written exam is replaced by an oral exam as a group exam with up to 3 people in an amount of 20 minutes per person; if applicable, this will be announced to the registered students at the end of the registration period as is customary in the faculty.	
ECTS credit points and grades	7 ECTS credit points If the laboratory course was assessed as “passed”, the module grade results from the arithmetic mean of the grades of the other two examinations. If the laboratory internship was rated as “failed”, the module grade M is calculated according to:	

	M = 0.2 · PL1 + 0.2 · PL2 + 0.6 · 5
Frequency	Annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-04	Geology and Exploration of Natural Energy Resources	apl. Prof. Dr. rer. nat. habil. St. Wagner TU Bergakademie Freiberg
Contents and objectives	Content: – Fluid mechanical properties of porous rocks and thermodynamics of pore fluids, – Basic laws of fluid mechanics, storage and Conveyor technology as well – Development of deposits of fluid raw materials (oil, natural gas, Water / geothermal energy) – Introduction to deep drilling technology (drilling rig, borehole construction, drilling, flushing, piping and cementation) Qualification goals: The students will master the classification of deposits. You are able to carry out a complex system analysis from the "upstream" (borehole) to the "downstream" area (heat exchanger / heat pump / power plant).	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G16 Technical Thermodynamics, RES-G17 Heat Exchange, RES-H09 Thermodynamics of Processes and RES-G18 Fluid Mechanics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. With more than 20 participants, it consists of a written exam of 120 minutes. In the case of up to 20 participants, the written exam is replaced by an oral exam as a group exam with up to 3 people in an amount of 20 minutes per person; if applicable, this will be announced in writing to the registered students at the end of the registration period.	
ECTS credit points and grades	7 ECTS credit points The module grade results from the grade of the examination performance.	
Frequency	Annually, in the summer semester	
Workload	210 hours	

Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-05	Processes and Machines for Low-Temperature and Waste Heat Utilization	Prof. Dr.-Ing. U. Gampe
Contents and objectives	Content: • Areas of application for heat pumps and ORC processes (ORC = Organic Rankine Cycle) • Working fluids and their characterization (thermodynamic, chemical and physical properties) • Process control of heat pump and ORC processes • Machine and plant technology • Energy economic assessment Qualification goals: 1. The students will master the design and conception of heat pump and ORC processes. 2. You are able to dimension heat pumps and expansion machines according to the respective application areas and working fluids.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, 1 hour per week lab courses, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G17 Heat Exchange, RES-H10 Principles of Fluid Flow Machinery, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module examination consists of three examinations: With more than 20 participants, the examination achievements consist of a written exam PL1 for qualification goal 1 or PL2 for qualification goal 2 of 90 minutes each and a laboratory course P. For up to 20 participants, the written exam is completed by an oral exam as a group exam with up to 3 people replaced in the amount of 20 minutes per person; if applicable, this will be announced in writing to the registered students at the end of the registration period.	
ECTS credit points and grades	7 ECTS credit points The module grade results from the grades of the examinations according to: $M = 0.4 \cdot PL1 + 0.4 \cdot PL2 + 0.2 \cdot P$	
Frequency	Annually, in the winter semester	

Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-06	Introduction to Numerical Solid and Fluid Mechanics	Prof. Dr.-Ing. habil. J. Fröhlich
Contents and objectives	Module content: – Introduction to methods for numerical calculation of solids and currents – Calculation of elastic bodies using the finite elements method and simulation of incompressible flows with finite volume methods – It includes basic knowledge of discretization procedures with which continuously given equations are converted into numerically solvable discrete systems and shows the possibilities as well as the limits of the procedures. Qualification goals: 1. The students will have the competence to use numerical methods (FEM). 2. You will know the elementary basics of flow simulation.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorials, 1 hour per week lab courses, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G15 Fundamentals of Kinematics und Kinetics and RES-G18 Fluid Mechanics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two written exams of PL1 120 minutes and PL2 90 minutes. If there are up to 20 participants, the written exam is replaced by an oral exam as a group exam with up to 3 people in an amount of 20 minutes per person; if applicable, this will be announced to the registered students at the end of the registration period as is customary in the faculty.	
ECTS credit points and grades	7 ECTS credit points The module grade consists to 2/3 of the grade for the exam of 120 min. and to 1/3 of the grade for the exam of 90 min.	
Frequency	annually, in every winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WK-07	Lightweight Components of Wind Turbines	Prof. Dr.-Ing. M. Gude
Contents and objectives	The students learn how to adapt the structures of modern wind energy plants to stresses in an optimum way. Therefore they can implement the design rules for light weight structures and apply relevant multi-disciplinar knowledge in the areas of material and structural mechanics, constructuion as well as production technology. The module includes the basics for the lightweight construction of a wind turbine. – Basics of fibre composites (fibres, matrices, semi-finished products, characteristics etc.) – Development of modern lightweight structures in fiber composite intensive mixed construction for use in wind turbines – Design principles for lightweight structures made of fiber composite materials – Basic and advanced calculation methods as classic laminate theory for anosotropic composites and stability hypotheses – Holistic view of all relevant lightweight manufacturing technologies (new manufacturing processes) and their impact on the property profile Qualification goals: 1. The students master: – to select the fibre components that are appropriate for the material in light weight structures – to properly dimension basic light weight structures or materials 2. They are able to exploit the potential of lightweight design for the construction of wind turbines.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G15 Fundamentals of Kinematics and Kinetics and RES-G20 Design Engineering and Manufacturing Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two written exams of 120 minutes and 90 minutes.	

ECTS credit points and grades	7 ECTS credit points. The module grade consists to 1/2 of the grade for the exam of 120 min. and to 1/2 of the grade for the exam of 90 min.
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-08	Calculation of Wind Turbines	Prof. Dr.-Ing. M. Beitelschmidt
Contents and objectives	Content: – Dynamics of machines, plants and components and management of models and calculation methods – Overview of the theory of linear vibrations with a finite degree of freedom, their application to vibrational machine problems – Construction and calculation of foundations up to block foundation with the degree of freedom six – Bending vibrations, especially special processes for estimation of natural frequencies and waveforms – Drive dynamics of free and bound systems including special problems of rotor dynamics – Construction and design of drive trains in wind turbines with and without gear taking into account the requirements for onshore and offshore applications – Modeling of drives and gearboxes of the wind energy plants and associated design processes Qualification goals: 1. Students will have the ability to be engineering-practical to translate questions into machine-dynamic models, to solve simple cases by hand calculations and to check the results obtained by computer simulations with roll-over calculations. 2. The students will be able to design drive trains of wind turbines and to apply the necessary calculation methods for drives of wind energy plants.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competences acquired in modules such as Introduction to Analysis and Algebra, Calculus for Functions with Several Variables Materials, Engineering Mechanics, RES-G15 Fundamentals of Kinematcis and Kinetics RES-G20 Design Engineering and Manufacturing Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two written exams of 120 minutes.	

ECTS credit points and grades	7 ECTS credit points The module grade consists to 1/2 of the grade for the exam of 120 min. and to 1/2 of the grade for the other exam of 120 min.
Frequency	annually, beginning in the winter semester
Workload	210 hours
Duration	2 semesters

Module number	Module name	Lecturer in charge
RES-WK-09	Electromagnetic Energy Conversion	Prof. Dr.-Ing. W. Hofmann
Contents and objectives	Content: 1. Design and calculation of electrical machines: parameters for optimum use of energy and general dimensions, windings and winding concepts, magnetic materials and magnetic circuit design, contacts: slip rings, brushes, commutator; determination and calculation of the machine parameters, loss calculation and efficiency, heating and cooling, concept development and optimization as well as laws of growth. 2. Transformers: power transformers; laws of growth; TK-number; core: structure, design, stationary mode and non-stationary mode; windings: structure and design of windings; insulation: terminology, insulation systems, insulation materials for transformers; design: core design, winding design, insulation design; clamping structures: terminology, principles, materials, design of core pressing elements, boiler design; sensors and control devices: oil monitoring, monitoring, EMC problems. Objectives: Having successfully completed this modules, the students have knowledge of the most important construction principles of electromagnetic power transformers and they are capable of designing, of calculating, of simulating with FEM and of rudimentally optimizing electrical machines and transformers.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorial, 1 hour per week practical lab course, 20 hours project, and self-study	
Prerequisites	Competences acquired in modules such as ET-12 02 04 Electrical Machines.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessement is passed. The module assessment consists of an oral exam of 40 minutes (PL1) as individual exam and a lab course (PL2).	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade (M) is derived from the weighted average of the grades of the elements of assessment: M=(7PL1+3PL2)/10	
Frequency	Annually, in the summer semester	

Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-10	Biomass Sources	Prof. Dr.-Ing. Beckmann
Contents and objectives	Content: – The emergence of various biomasses (wood, energy crops, agricultural residues, biogenic residues) – Deployment and preparation procedures – Characterization with regard to chemical, mechanical, caloric and reaction properties – Use strategies depending on the properties for the energetic and material use (cascade use) – Energetic evaluation of the process chains Qualification goals: 1. The students will master the procedures of the provision processing and processing of biomass types and can characterize relevant properties. 2. They will have the ability to energetic process chains evaluate.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorials, 1 hour per week lab courses, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G16 Technical Thermodynamics, RES-G17 Heat Exchange, RES-G18 Fluid Mechanics, as well as RES-H01 Specifics of Renewable Energy Systems, RES-H09 Thermodynamics of Processes, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 120 minutes and an ungraded laboratory course.	
ECTS credit points and grades	7 ECTS credit points can be earned. If the lab course was assessed as “passed”, the module grade results from the grade of the written examination. If the lab course was rated “failed”, the module grade is calculated according to: $M = 0.4K + 0.6 \cdot 5$	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WK-11	Biomass for Energy	Prof. Dr.-Ing. M. Beckmann
Contents and objectives	Content: – Fundamentals of reaction technology with regard to the conversion of gaseous, liquid and solid fuels and associated pollutant generation and degradation mechanisms, – Process control in the fermentation, pyrolysis, gasification and combustion of various biomasses as well as the basics for downstream synthesis processes (gas processing, BtL), – Essential apparatus and its use in the processes of energy process engineering. Qualification goals: 1. The students will master the basics of reaction kinetics. 2. They will be able to characterize fuels, choose suitable process controls and dimension equipment technology.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorials, 2 hours per week lab courses.	
Prerequisites	Competences acquired in modules such as Physics, Materials, Engineering Mechanics, RES-G16 Techical Thermodynamics, RES-H09 Thermodynamics of Processes, RES-G18 Fluid Mechanics, RES-G17 Heat Exchange, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 150 minutes and an ungraded lab course.	
ECTS credit points and grades	7 ECTS credit points can be earned. If the lab course was assessed as “passed”, the module grade results from the grade of the written examination. If the lab course was rated “failed”, the module grade is calculated according to: $M = 0.4K + 0.6 \cdot 5$	
Frequency	annually, in the winter semester	
Workload	210 hours	

Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-12	Fuel Cells	Prof. Dr. A. Michaelis
Contents and objectives	Content: Balancing of material and energy flow in energy conversion plants (esp. fuel cell systems), definition of applied variables and terms related to energy and reaction, design of reactors with heterogeneous catalysed reactions, thermodynamic analysis of fuel cell systems, fundamentals of electromechanical energy conversion in the fuel cell, types of fuel cells and their design and function, fuel cell stack structure and function, system components and structure of the fuel cell systems, processes of synthesis gas production and gas treatment, thermal and catalytic afterburning of anode exhaust gas, characterization of the electrochemical properties of cells and stacks, efficiency of different system variants and its dependence on the applied fuel, requirements for fuel cell systems for different fields of application, life cycle and degradation of fuel cells and systems, fundamentals of electrolysis and cogeneration with chemical syntheses, (power-to-gas and power-to-liquids), storage concepts for electrical energy from renewable sources and meaning of the fuel cell technology for future power supply systems. Qualification goals: After successfully completing this module, the students will have broad basic knowledge in the field of fuel cell systems and electrolysis. The students are able to balance the quantity of substances and the energy on systems for energy conversion and energy storage, to describe the functioning of the fuel cell systems and to name the potential areas of application, to explain the components of the fuel cell system and their functioning, to calculate the efficiency of the energy conversion in the fuel cell system. They know the fundamentals in order to design reactors for fuel cell systems.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competencies acquired in modules such as Physics, Materials, Engineering Mechanics, RES-G16 Technical Thermodynamics, RES-H09 Thermodynamics of Processes, RES-G18 Fluid Mechanics, RES-G17 Heat Exchange, or equivalent.	

Requirements for the award of ECTS credit points	The credit points are awarded when the module assessment is passed. With more than 20 participants, it consists of a written exam lasting 120 minutes. In the case of up to 20 participants, the written test is replaced by an oral exam as an individual exam of 30 minutes; if applicable, this will be announced to the registered students at the end of the registration period as is customary in the faculty.
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the grade of the written exam.
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-13	Electric Drives	Prof. Dr.-Ing. W. Hofmann
Contents and objectives	The module includes – Basics and dimensioning of electric drives: Introduction, motion processes, heating processes, applications of the equation of motion, work machines and motion converters, motor selection according to nominal operating modes; – Speed and torque control of drives: converter-fed DC drives, pulse converter-fed DC drives, speed control of asynchronous drives, slip-controlled asynchronous drives, frequency-controlled asynchronous drives, frequency-controlled synchronous drives, actuators; – Regulation of drives: Drive controls, regulated DC drives, regulated three-phase drives, field-oriented control, applications: machine tools, vehicles, mechatronics Qualification goals: After completing the module, the students will have the ability to make an application-oriented drive selection, to understand the operating behavior of electrical drives using replacement circuit diagrams, and to assess the control and regulating properties using suitable calculations and measurements.	
Modes of teaching and learning	3 hours per week lectures, 1 hour per week tutorials, 1 hour per week lab courses and self-study.	
Prerequisites	Competences acquired in modules such as RES-G09 Electrical Power Engineering, RES-H06 Electrical Machines, RES-H05 Power Electronics, or equivant.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam PL1 of 180 minutes and the lab course P.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is based on: $M = 0.7 \cdot PL1 + 0.3 \cdot P$	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WK-21	Fundamentals of Energy Storage	Prof. Dr.-Ing. P. Schegner
Contents and objectives	Contents of the module are – thermal and mechanical energy storage, – compressed air storage systems as well as – electrical and electrochemical storage systems. Qualification goals: After completing the module, the students will understand the basic properties of the different energy storage systems and know criteria for their comparative evaluation. You can select and dimension the energy storage systems for various applications (e.g. short or long-term storage). In addition to the technical assessment, they are also familiar with the economic and ecological aspects of the storage systems.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competencies acquired in modules such as RES-G09 Electrical Power Engineering, RES-H01 Specifics of Renewable Energy Systems, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are awarded when the module assessment is passed. The module examination consists of a written exam of 180 minutes. With up to 5 participants, the written exam is replaced by an oral exam as individual exam of 45 minutes.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the grade of the exam.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WK-22	Dam Engineering and Hydroelectric Power Engineering	Prof. Dr.-Ing. J. Stamm
Contents and objectives	The module contains basic and special hydraulic aspects in planning, construction and operation for various types of dams. The hydraulic and functional optimization of the structure, the tightness and stable integration of the structure into the subsoil as well as the construction and operation of dams form a special focus. Students are thus able to weigh and assess water management, operational and ecological aspects. They have in-depth competences for constructive design and hydraulic dimensioning, for monitoring, for the renovation and modernization of old systems, especially river and dams. The students are thus able to assess the function of a storage facility comprehensively. Another focus is the energetic use of dams by means of hydropower plants. The students have an insight into energy economics terms and topics, renewable energies, turbine types and their characteristic diagram, run-of-river power plants, power plant chains or small hydropower plants and are able to assess ecological conflict points and measure plant parts and their profitability.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorial, a project and self-study.	
Prerequisites	Competences acquired in modules such as RES-G12 Fundamentals of Renewable Energy Systems and RES-G18 Fluid Mechanics, or equivalant.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module examination consists of a written exam K1 (120 min) on dams, a written exam K2 (120 min) on hydro-power plants and an ungraded project work on hydropower plants of 30 hours.	
ECTS credit points and grades	7 ECTS credit points If the project work was rated as “passed”, the module grade is based on: $M = 0.5 \cdot K1 + 0.5 \cdot K2$ If the project work was rated as “failed”, the module grade is calculated according to: $M = 0.2 \cdot K1 + 0.2 \cdot K2 + 0.6 \cdot 5$	
Frequency	annually, beginning in the winter semester	

Workload	210 hours
Duration	2 semesters

Module number	Module name	Lecturer in charge
RES-WK-24	Chemical Thermodynamics	Prof. C. Breitkopf
Contents and objectives	Students will be able to develop thermal equations of state for distinguish and calculate ideal and real gases, as well as identify the uses of real gas equations. They learn to find the right thermodynamic technical vocabulary (state and process as well as 1st and 2nd law) for material conversion processes (phase transitions of pure substances, mixed phase formation, chemical reactions). Students will also be able to study material transformation processes with the help of the respective phase diagrams and describe the basic laws of thermodynamics. They know the characteristics of chemical thermodynamics fundamental equations and can calculate their temperature and pressure dependency. The students are familiar with energy and process relevant characteristics of mixtures and their characteristics turnarounds. Contents of the module are thermal equations of state for ideale and real gases (virial equations, van der Waals equation), State variables of mixtures (partial molar quantities), thermochemistry of material transformation processes (enthalpy of reactions, Hess's theorem, temperature and pressure dependence thermo-chemical state variables), General laws of equilibrium and non-equilibrium (fundamental equations, Gibbs and Helmholtz Energy, Chemical Potential) and applications to material conversion processes; Phase equilibria of pure substances (phase diagrams, vapor pressure, fusion pressure, sublimation pressure curves, Clausius-Clapeyron, classification of phase over-according to Ehrenfest), mixed-phase equilibria, specifically: Solvent equilibria (freeze-temperature low, boiling temperature increase, colligative properties) and their applications, solubility and distribution equilibrium weights (Henry coefficient, Nernst distribution factor) and their applications, vapor-liquid equilibria (Raoult's and Dalton's law, temperature and pressure composition, respectively (e.g. diagrams) and their applications as well as systems with liquid and solid phases (melt equilibria with complete dig and completely incomplete miscibility of solid phases, eutectics) and their applications (Fe-C diagram, latent storage cher); chemical equilibria (van-t Hoff's reaction isotherme, law of mass action, dealing with equilibrium constant, temperature and pressure dependence of the equilibrium weight constants). Basic thermodynamic properties; these are to be deepened in the practical lab course.	
Modes of teaching	2 hours per week lectures, 2 hours per week tutorial, 1 hour	

and learning	per week practical lab course and self-study.
Prerequisites	Competences acquired in modules such as RES-G16 Technical Thermodynamics.
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module examination consists of a written exam of 120 minutes.
ECTS credit points and grades	7 ECTS credit points. The module grade is the grade of the examination.
Frequency	annually, in the wimmer semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-31	Network Integration, System Performance and Quality of Supply	Prof. Dr.-Ing. P. Schegner
Contents and objectives	The module contains different aspects of the quality of supply as voltage quality, supply reliability and relevant national and international standards. Further, it contains aspects of how electrical equipment is exposed to special stationary and transient operation processes. Qualification goals: The students will be able to evaluate the affects of consumer and generation systems on the voltage quality. The will know the methods to evaluate the supply reliabilty of the electric energy supply as well as calculation results. Further, they will be familiar with special stationbary and transient operation processes as well as their effects.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorial, 1 hour per week lab courses, and self-study.	
Prerequisites	Competences acquired in modules such as Basics of Electrical Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 150 minutes and a lab exam. With up to 5 participants, the written exam can be replaced by an oral exam as individual exam of 45 minutes.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the weighted mean of the examinations: M = (3 PL1 + 2 PL2) / 5	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WK-32	Heat Supply	Prof. Dr.-Ing. Clemens Felsmann
Contents and objectives	Content: – municipal and industrial district heating supply – heating technology and drinking water heating; heat distribution and heat use in buildings as well as combined heating and cooling systems. – technologies of heat supply, heat transfer within the networks and to the customer – network design, pressure maintenance, safety requirements – regulation and optimization of heating networks considering the heat storage – requirements concerning decentralised heat feeding, multifunctionality and integration of renewable energy sources into heat networks – central and decentralised heat and power and cooling processes Qualification goals: 1. The students will know the construction and the main components of central and decentralised systems of district heat supply. They will be able to plan, construct and operate these systems. They will know methods of optimizing such systems. 2. The students will know about the construction and main components of space heating and cooling as well as drinking water heating. They will be able to plan, construct and operate these systems. They will know methods of optimizing such systems.	
Modes of teaching and learning	4 hours per week lectures, 1 hours per week tutorial, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G16 Technical Thermodynamics, RES-G17 Heat Exchange, RES-H09 Thermodynamics of Processes, RES-H10 Principles of Fluid Flow Machinery, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 180 minutes. With up to 20 participants, the written exam will be replaced by an oral exam as group exam with maximum 3 students and of 30 minutes per student.	

ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the grade of the assessment.
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-33	Hydrogen Technologies	Prof. Dr.-Ing. habil. A. Hurtado
Contents and objectives	This module includes basic aspects about the current available technical and technological requirements of a hydrogen-based energy industry (generation, storage, transport, application). It also includes further development trends in this area as well as the general energy conditions for a hydrogen energy industry (efficiency, costs, price structures). The module also focuses on low-temperature, process and storage technologies as well as safety-related aspects. Qualification goals: 1. The students will master the casics of hydrogen technology and know the associated components for a hydrocarbon-based energy industry. 2. The students will know the basics of low-temperature and storage technology for the energy source hydrogen.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorial and self-study.	
Prerequisites	Competencies acquired in modules such as RES-G16 Technical Thermodynamics, RES-H01 Specifics of Renewable Energy Systems, RES-H03 Introduction to Energy Economics and Management, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are awarded when the module assessment is passed. The module examination consists of two written examinations of 90 each.	
ECTS credit points and grades	7 ECTS credit points The module grade results from the grades of the examinations according to: $M = 0.5 \cdot K1 + 0.5 \cdot K2$	
Frequency	Annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WK-41	Demand Response	Prof. Dr.-Ing. C. Felsmann
Contents and objectives	The module contains the characteristics of thermal and electric load curves as well as of the heating, cooling and electricity demand of buildings and insustrial processes. Dependencies between temporal load requirements and different influencing factors will be analysed. Qualifiaction goals: The students will be able to determine the energy demand and energy indicators by means of specific load curves of buildings and industrial processes taking into account the different supply structures and usage requirements. The will be familiar with the methods and potentials of the load management considerung selected storage technologies. They will know how to evaluate the energy efficiency during energy use.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorial, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G17 Heat Exchange, RES-G09 Electrical Power Engineering, RES-H10 Principles of Fluid Flow Machinery RES-H01 Specifics of Renewable Energy Systems, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 180 minutes. With up to 10 participants, the written exam will be replaced by an oral exam as individual exam of 45 minutes.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the grade of the assessment.	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WK-42	Project Managament	Prof. Dr.-Ing. habil. A. Hurtado
Contents and objectives	The modules contains the following fields which will be discussed by means of practical examples: – basic knowledge about dealing with project related management tasks – interaction between single aspects of project management – sustainability, innovation and change management – management of international projects – instruments and methods of technology assessment – legal framework Qualification goals: The students will be able to manage complex projects in the field of renewable energy systems considering technological, economical, ecological and social aspects. They will be able to work-oriented.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week seminar, a project, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G16 Technical Thermodynamics, RES-H01 Specifics of Renewable Energy Systems, RES-H03 Introduction to Energy Economics and Management, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam (K) of 120 minutes and a project work (P) of 30 hours.	
ECTS credit points and grades	7 ECTS credit points The module grade results from the grades of the examinations according to: $M = 0{,}6 \cdot K + 0{,}4 \cdot P$	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
RES-WK-43	Process Simulation and Operation	Prof. Dr.-Ing. habil. L. Urbas
Contents and objectives	The module contains knowledge-based methods and algorithms for automated process evaluation, process diagnosis and process control. Qualification goals: The students will be able to plan, design, implement and operate complex knowledge-based close-to-process (partially)automated information processing systems. They will be able to combine and use such methods in systems theory and automation terms in order to create complex automation systems.	
Modes of teaching and learning	3 hours per week lectures, 3 hours per week tutorials, and self-study.	
Prerequisites	Basic knowledge and skills in programming in a line-oriented language (C, Matlab or others).	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam (PL1) of 90 minutes, an oral exam (PL2) of 30 minutes, and a project work (PL3) of 30 hours.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the weighted mean of the examinations according to: M = (PL1 + PL2 + PL3) / 3.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
RES-WK-44	Controlled Power Systems	Prof. Dr.-Ing. W. Hofmann
Contents and objectives	Content: 1. Controlled energy systems: Definition of energy and performance, general control structures; synchronous generator: energy converters, modelling, regulation; network and isolated operation; asychronous generators: single andf double fed energy converters, modelling, regulation; network and isolated operation; exemplary regulations: steam power plant, hydropowerplant, wind power plant, pump storage plant; flywheel accumulators: flywheel, motor/generator, converter, magnetic bearings, construction, regulation; grid control: primary, secondary and tertiary regulation; power flow regualtors: contact based, line commulated, self commutated FACTS, regulating transformers, active filters; high voltage direct current transmission and 2. Electrical machine dynamics: Methods and types, dynamic behaviour of orthogonal windings – externally excited direct current machine, dynamic behaviour successive windings – transformers, torque determined from energy efficieny or field sizes, types of space vectors, transmission behaviour and dynamic operating status of induction machines, upper shafts analysis, harmonics analysis, zero sequence networks, wave processes and stress analysis. Objectives: The students will have knowledge of the design and the operating behaviour of electric energy transformers in power plants. They will understand the dynamic processes in electrical machines and networks, and they can design and optimize regulated plants.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorial, 1 hour per week practical lab course, 1 project (20 hours), and self-study.	
Prerequisites	Competences acquired in modules such as RES-H06 Electrical Machines, RES-H07 Control of Continuous Time Processes, or equivalent.	

Requirements for the award of ECTS credit points	The credit points are earned if the module assessement is passed. The module assessment consists of an oral exam of 40 minutes (PL1) as individual exam and a lab course (PL2).
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade (M) is the weighted average of the grades of the assessments: M= (7PL1+3PL2)/10
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-46	Energy efficiency, Energy management and Energy Economics	Prof. Dr.-Ing. C. Felsmann
Contents and objectives	The module contains: – energy management, efficient energy usage by analysing requirement structures, load forecast, energy storage, and optimized operation of plants – basics of the legal working techniques taking into account environmental law, environmental constitutional law, and environmental administrative law; principles and control elements of environmental law; renewable energy systems; recycling economy protection law, water protection law, nature protection law, soil protection law. Qualification goals: 1. The students will know methodical approaches in order to increase efficieny and optimize the operation of energy systems. They will have detailed knowledge in the organization and technical realization of energy management measures. 2. The students will know methodical approaches in order to deal with the regulations in the field of environmental law. They are familiar with the basics of the environmental law and have basic knowledge in the legal interrelations within the environmental law. They can solve problems regarding environmental law on the basis of the applicable law.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorial, and self-study.	
Prerequisites	Competences acquired in modules such as RES-G17 Heat Exchange, RES-H09 Thermodynamics of Processes, RES-H10 Principles of Fluid Flow Machinery RES-H02 Fundamentals of Electrical Power Systems, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 120 minutes (PL1) and a written exam of 90 minutes (PL2). With up to 10 participants, the written exam PL1 will be replaced by an oral exam as group exam with up to 3 students and 20 minutes per student.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is derived from the grades of the examina-	

	tions according to: M = 0,7 · PL1 + 0,3 · PL2
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-48	Fundamentals of Refrigeration, Air Conditioning Technology and Heat Pumps	Prof. Christiane Thomas christiane.thomas@tu-dresden.de
Contents and objectives	The module contents include the calculation of cooling requirements, the calculation of stationary system behaviour, the special features of the significant system components, the characterization and special features when using different refrigerants as well as the energy balance of the overall system. Other topics include sorption systems, cold gas machines and alternative methods of cold and heat generation. Furthermore, the module content includes the thermodynamic basics of the mixture of humid air, the basics of human thermal physiology, the basics of determining air exchange rates on the basis of stationary and transient CO2 and pollutant balances, the basics of humidifying and dehumidifying air and air flow in buildings and energy balancing for evaluating air conditioning systems. The module also covers the balancing of different basic types of air conditioning systems, such as single-duct, two-duct and air-water air conditioning systems, and the detailed description of their components. The module is rounded off with knowledge of air conditioning processes based on renewable energies, such as DEC air conditioning systems. Students will know the basics of refrigeration and heat pump technology with regard to system technology and the most important components as well as the natural and synthetic refrigerants used. Students know the special features and areas of application of cold vapor compression, sorption and cold gas machines as well as alternative refrigeration and heat generation and the procedure for the energy balancing of the systems. They will know the basics of air conditioning technology with the fundamental aspects of thermal physiological and hygienic parameters, the design of air conditioning systems, the thermodynamic relationships of the Mollier h,x diagram with special reference to humidification and dehumidification, the significant changes in state for air conditioning technology and the balancing of air conditioning systems in the temperature range 6°C to 18°C.	
Modes of teaching and learning	4 hours per week lectures, 1 hours per week tutorial, 1 hour per week practical lab course, and self-study.	
Prerequisites	The skills to be acquired in the modules **Technical Thermodynamics** and **Heat Exchange** are required.	

Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a collection of lab protocols (P) and a written exam of 180 minutes (K). Both the collection of lab protocols and the exam have to be passed.
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the weighted mean of the examinations: $M = (4 \cdot K + 1 \cdot P)/5$
Frequency	The module is offered every summer semester.
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WK-51	Introduction to Landscape and Spatial Planning and Environmental Law	Prof. Clemens Felsmann
Objectives	1. Students will have basic knowledge of landscape planning, regional and urban land-use planning and environmental assessment instruments such as impact regulation, fauna-flora-habitat (FFH) impact assessment and environmental audits. They are able to classify and assess current environmental problems and discussions. They will be able to differentiate and categorize environmental planning services with regard to their tasks, areas of application and objects of consideration. 2. Students will know the methodological approaches to working with laws in the field of environmental law; they are familiar with the main features of environmental law and have basic knowledge of the legal contexts in this area of law and can use the knowledge they have acquired to independently solve environmental law issues - applying applicable law.	
Contents	The module includes basic knowledge of the system of landscape planning in relation to the planning levels of spatial planning, including the tasks and contents of landscape planning and spatial and urban land-use planning, as well as an overview of environmental assessment instruments such as the impact regulation, the fauna-flora-habitat (FFH) impact assessment and environmental assessments. Basic regulations of nature conservation law are presented and explained as well as the legal regulations of the Federal Building Code (BauGB) on urban land use planning and the Spatial Planning Act (ROG) on spatial planning. The basics of legal working techniques are taught based on the legal field of environmental law. This includes: environmental constitutional law and environmental administrative law; principles and control elements of environmental law; renewable energy systems; recycling management, water, nature and soil protection law.	
Modes of teaching and learning	4 hours per week lectures, and self-study.	
Prerequisites	No special knowledge is required.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 90 minutes (PL1) and another written exam of 90 minutes	

	(PL2).
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the unweighted mean of the examinations: M = 0,5 · PL1 + 0,5 · PL2
Frequency	The module is offered every winter semester.
Workload	210 hours
Duration	1 semester

Module descriptions
Main studies modules 5th-10th semester
(Complimental Modules)

Module number	Module name	Lecturer in charge
RES-WE-01	Particle Technology for Renewable Energy Systems	Prof. Dr.-Ing. habil. M. Stintz
Contents and objectives	The module contains the basics of particle characterization in suspensions, bulk solids and aerosols as well as in composite materials. Further, selected mechanic processes such as crushing, storing and dosing of bulk materials as well as processes for dedusting gas flows will be taught. Qualification goals: The students will be able to characterize disperse systems in different states. They will be able to create and optimize selected mechanic processes in order to change disperse systems.	
Modes of teaching and learning	3 hours per week lectures, 1 hour per week tutorial, 1 hour per week practical lab course, and self-study.	
Prerequisites	none	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two written exams of 90 minutes (K1) and 120 minutes (K2), and a practical lab course (Pr).	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is derived from the grades of the examinations according to: $M = 0{,}2 \cdot K1 + 0{,}5 \cdot K2 + 0{,}3 \cdot Pr$	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WE-02	Electromagnetic Compatibility	Prof. Dr. rer. nat. habil. H. G. Krauthäuser
Contents and objectives	The module contains topics and questions regarding electromagnetic compatibility of technical systems and regarding automated measurement procedures with a particular focus on measurement uncertainties. Qualification goals: The students will be able to deal with theorectical and practical questions regarding electromagnetic compatibility. The will know the legal EU frameworks and will be familiar with the most important standards. The students will be able to reveal possible couplings for unwanted effects of electromagnetic interference and take countermeasures. Further, the students will be able to plan complex measuring procedures and map them in programmes.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week practical lab course, and self-study.	
Prerequisites	none	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 120 minutes (PL1) and the practical lab exam. With up to 20 participants, the written exam PL1 will be replaced by an oral exam as individual exam of 40 minutes each.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is derived from the grades of the examinations according to: $M = 2/3 \cdot PL1 + 1/3 \cdot PL2$	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WE-03	Protection and Control of Electrical Power Systems	Prof. Dr.-Ing. P. Schegner
Contents and objectives	The module contains the design and principle of operation of the protection and control technology in electrical power systems. Further, it contains essential criteria of selective protection technology and the algorithms used. Qualification goals: The students will be able to 1. evaluate criteria for identifying possible errors in electrical power systems in terms of suitability and accuracy. They will be able to design protection technology and to determine the necessary setting parameters. 2. interprete the interfaces between process and subsystems of secondary technology. They will be able to interprete different communication topologies and they will be familiar with the communication protocols used in switchboards.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorial, 1 hour per week practical lab course, and self-study.	
Prerequisites	Competences acquired in modules such as RES-WK-31 Network Integration, System Performance and Quality of Supply, RES-H02 Fundamentals of Electrical Power Systems, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The assessment consists of two written exams (of PL1 120 minutes and of PL2 90 minutes) and a PL3 lab course. With up to 5 registered students the written exams can be replaced by two oral exams as individual exams of 45 and 30 minutes. The lab course has to be completed successfully.	
ECTS credit points and grades	7 ECTS credit points can be earned. The grade is derived from the weighted average of the grades of the examinations according to: M = (2 PL1 + 1 PL2 + 2PL3) / 5.	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WE-04	Planning of Electrical Power Systems	Prof. Dr.-Ing. P. Schegner
Contents and objectives	Contents: - mathematical methods for calculating the stress of individual equipment within electrical power systems and - the principles of planning electro technical installations and distribution networks. Intended learning outcome: The students are able to calculate and assess holistically, steady and transient stress. They have mastered all important procedures and methods to dimension respectively select the equipment with regard to their voltage and current stresses and other criteria. The students know the basic standards for the planning.	
Modes of teaching and learning	4 hours per week lectures, 3 hours per week tutorials, and self-study	
Prerequisites	Competences acquired in modules such as RES-H02 Fundamentals of Electrical Power Systems, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The assessment consists of a written exam of 120 minutes (PL1) and two written exams of 90 minutes (PL2 and PL3). With up to 5 registered students the written exams can be replaced by an oral exam as individual exam of 45 minutes (PL1) and two oral exams as individual exams of 30 minutes (PL2 and PL3).	
ECTS credit points and grades	7 ECTS credit points can be earned. The grade is derived from the weighted average of the grades of the examinations according to: M = (4 PL1 + 3 PL2 +3 PL3) / 10	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WE-05	High Voltage Engineering	PD Dr.-Ing. habil. S. Schlegel
Contents and objectives	The module contains selected topics from – High voltage engineering – Insulation technology – Lightning protection Qualification: After successful completion of the module, the students will be able to evaluate the function, design and rating of electrical equipment. Furthermore the students will learn simplified methods to dimension and test electrical equipment.	
Modes of teaching and learning	5 hours per week lectures, 1 hour per week practical lab course, and self-study.	
Prerequisites	Competences acquired in modules such as RES-H04 High Voltage and High Current Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The assessment consists of an oral exam as individual exam of 30 minutes (PL1) and a lab course (PL2).	
ECTS credit points and grades	7 ECTS credit points can be earned. The grade is derived from the weighted average of the grades of the examinations according to: M = (7 PL1 + 3 PL2) / 10	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WE-06	Stress of Electrical Equipment	PD Dr.-Ing. habil. S. Schlegel
Contents and objectives	The module contains – Basics of the design and operational mode of electrical equipment with high current load in electrical power engineering Qualification: By completing the module successfully, the students will be able to rate, evaluate and test components of systems with high current load. They will be enabled to do scientific research on the subject.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week practical lab, 1 project, and self-study.	
Prerequisites	Competences acquired in modules such as RES-H04 High Voltage and High Current Engineering, RES-WE-05 High Voltage Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The assessment consists of an oral exam as individual exam of 30 minutes (PL1), one project (PL2), and a practical lab course (PL3).	
ECTS credit points and grades	7 ECTS credit points can be earned. The grade is derived from the weighted average of the grades of the examinations according to: M = (2 PL1 + PL2 + PL3) / 4.	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WE-07	Microprocessor Control in Power Electronics	Prof. Dr.-Ing. St. Bernet
Contents and objectives	The module contains: - the design and function of common power electronic topologies for energy and drive applications, - analyses of the characteristics and simplification of the topologies for the modelling in order to design the control, - common modulation methods for the generation of the control signals and possible implementations on digital control platforms, - common feed-forward and feed-back control algorithms and issues of the implementation on digital control platforms, - programming of the control of a voltage source converter in order to operate an induction motor. Objectives: The students are capable of implementing controllers on a digital control platform by using a high-level programming language. They are capable of understanding the structure and function of a digital control platform, and of rating the main characteristics of a digital control platform in relation to the application, and of evaluating the pros and cons of different solutions.	
Modes of teaching and learning	2 hours per week lectures, 1 hour per week tutorial, 2 hours per week practical lab course, and self-study.	
Prerequisites	Competences acquired in modules such as RES-H05 Power Electronics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessement is passed. The module assessment consists of an oral exam (PL1) of 20 minutes as group exam with up to 3 students and of 20 minutes per student, and a project of 3 weeks (PL2).	
ECTS credit points and grades	7 ECTS credit points can be earned. The grade is derived from the weighted average of the grades of the examinations according to: M = (PL1 + 3 PL2) / 4.	
Frequency	annually, in the summer semester	
Workload	210 hours	

Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WE-09	Design of Power Electronic Systems	Prof. Dr.-Ing. St. Bernet
Contents and objectives	The module contains - the function of basic topologies (DC/DC converter, voltage source converter) in order to derive a mathematical model, - modelling of common power semiconductor switches, - calculation of the system variables at a stationary operating regime, - design of the passive components of power electronic systems, - design of common feed-forward and feed-back control algorithms, - verification of the function with simulation tools. Objectives: The students are capable of using basic methods to simplify a power electronic system and its components in order to derive a mathematical model. The students are capable of calculating the system variables with the mathematical model, and of designing the components and the control including observers.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, 40 hours project, and self-study.	
Prerequisites	Competences acquired in modules such as RES-H05 Power Electronics, RES-WK-02 Power Electronics for Photovoltaics and Wind Energy Plants, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessement is passed. The module assessment consists of an oral exam of 40 minutes as individual exam (PL1) and a project PL2.	
ECTS credit points and grades	7 ECTS credit points can be earned. The grade is derived from the mean of the grades of the examinations according to: M = (PL1 + PL2) / 2.	
Frequency	annually, in the winter semester	

Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WE-11	Autonomous Microsystems	Dr.-Ing. habil. U. Marschner
Contents and objectives	The module contains: - The principles and constructive solutions of autonomous microsystems from a very wide range of applications. - The physical principles of sensors from a wide range of applications. - The basics of the materials used in microsystem technology. Qualification goal: The students will be able to develop autonomous systems based on knowledge of the basic material properties and the resulting sensor properties.	
Modes of teaching and learning	6 hours per week lectures, and self-study.	
Prerequisites	Competences acquired in modules such as RES-H08 Measurement and Sensor Techniques, Materials, Engineering Mechanics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two oral exams as individual exams of 15 minutes each and a written exam of 90 minutes.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is derived from the arithmetic mean of the 3 exams.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
RES-WE-13	Selected Topics of Electrical Power Engineering	Head of specialization area Electrical Power Engineering
Contents and objectives	Contents of the module are current topics and questions of the electrical power engineering. Outcomes: After successful completion of the module, the students can deal with current and relevant and research-active areas of electrical power engineering. They can question and crosslink the knowledge acquired using new methodological approaches and contents.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Competences acquired in modules such as RES-G09 Electrical Power Engineering, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of an oral exam as individual exam of 40 minutes.	
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the grade of the oral exam.	
Frequency	annually, beginning in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
RES-WE-14	CommunicationTechnology for Thermal and Electrical Power Engineering	PD Dr.-Ing. habil. J. Seifert
Contents and objectives	Contents of the module are the different methods of data transmission with a special focus on the sector coupling in energy technology. Starting with the requirements of the different energy markets in regard to the provision of data, the status quo of digitization is presented. In terms of content, current applications such as Smart Home Systems, virtual power plants and intelligent measuring systems is discussed. In addition to the technical basics also communication protocols for energy management (i. e. IEC 60780-5-104) and the respective specific system architecture (areas: provision/ storage/ distribution/ application) are taught. The teaching program includes all energetic areas (i.e. electrical energy technology, gas technology and heating technology). Another teaching focus is the structured preparation and analysis of forecasting and measurement data. In this regard, the teaching program includes simple evaluation algorithms (monitoring) up to complex optimization strategies. Another focus of the module is the teaching of modern, complex analysis methods. This includes the application of existing simulation programs, the generation of input parameters as well as the evaluation of the results. Further, analysis methods in the field of hardware in the loop and human in the loop methods are taught. Objectives: The students will know the methodology for the systemic design and optimization of digital infrastructures with a special focus on energy technology. Qualifications regarding digital infrastructure in all areas of energy technology (provision/ distribution/ application) as well as gas, heating and electricity sectors are provided. Further, the students will learn different methods of data collection and data evaluation for energy technical systems as well as the optimized control of decentralized energy systems.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorials, and self-study	
Prerequisites	Competences acquired in modules such as RES-G16 Technical Thermodynamics, RES-G09 Electrical Power Engineering, or equivalent.	

Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 180 minutes.
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the grade of the written exam.
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WE-15	Innovative Applications of Energy Storage Systems	Prof. Dr.-Ing. T. Bocklisch
Contents and objectives	The contents of the module contain methods and system concepts for storage demand analysis, storage integration and storage coupling in sustainable energy supply structures based on a high proportion of renewable energies between the sectors electricity, heat, transport and chemical raw materials. Contents of the module are basic principles, design and operational management procedures for hybrid systems and hybrid energy storage systems as well as typical fields of application (amongst others regenerative combination power plants, district storage concepts, self-sufficient energy supply systems as well as hybrid electricity, heat and gas storage in the industry). Furthermore, the innovation potentials of different energy storage technologies in regard to the further development of storage and conversion components (i. e. operating principles, design, materials used), the methods applied (i. e. for periphery control circuits) and the system technology (i. e. energetic/ information technology coupling structures, system analytical approaches). Objectives: The students will know advanced functional principles of electrical, mechanical, electrochemical and thermal energy storage and can choose correctly suitable energy storage technologies in combination with other flexibilization technologies for different fields of application. The students will know the importance of cross-sectoral energy use, and basic principles, coupling methods as well as dimensioning and operational management procedures for simple and hybrid energy storage systems in stationary, mobile and portable applications. They will know the innovation potential of the individual energy storage technologies in regard to the further development of storage and transformation components, the methods used for subordinate control and application-oriented operational management as well as the system engineering energy supply and coupling structures.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Competences acquired in modules such as RES-WK-21 Fundamentals of Energy Storage, or equivalent.	
Requirements for the award of ECTS	The credit points are earned if the module assessment is	

credit points	passed. The module assessment consists of a written exam of 180 minutes. With up to 20 students the written exam will be replaced by an oral exam as group exam with up to 3 students and of 30 minutes per student.
ECTS credit points and grades	7 ECTS credit points can be earned. The module grade is the grade of the exam.
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	**Module name**	**Lecturer in charge**
RES-WE-16	Experimental High Voltage Engineering	PD Dr.-Ing. habil. S. Schlegel
Contents and	The module contains	

objectives	– High voltage test technique – Measurement technique – Scientific methods for planning experiments and their statistical evaluation. Qualification: After successful completion of the module, the students will be able to plan and perform scientific experiments as well as to evaluate them statistically. The students will gain HV-related and methodical knowledge for scientific research on the subject.
Modes of teaching and learning	4 hours per week lectures, 2 hours per week practical lab courses, and self-study
Prerequisites	Competences acquired in modules such as RES-H04 High Voltage and High Current Engineering, RES-WE-05 Specialization High Voltage Engineering, or equivalent.
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The assessment consists of a lab course and an individual oral as individual exam of 30 minutes.
ECTS credit points and grades	7 ECTS credit points can be earned. The grade for this module is determined by the weighted average of the lab course and the oral exam. The oral exam is weighted as 70% of the module grade and the lab course as 30%.
Frequency	annually, in the winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
RES-WE-17	Optical Process Measurement	Prof. Dr.-Ing. J. Czarske
Contents and objectives	The content of the module includes the basic principles, the theoretical treatment and the practical implementation of optical measuring systems. This refers to mechatronic laser sensors, laser measurement systems for fluid technology, project work on optical process measurement technology. Qualification: The students will be able to implement optical measuring systems and use them to measure interesting physical quantities.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per project, and self-study	
Prerequisites	Competences acquired in modules such as Physics, RES-H08 Measurement and Sensor Techniques, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The assessment consists of an oral exam as individual exam of 30 minutes (PL1) and a semester project work of 60 hours (PL2).	
ECTS credit points and grades	7 ECTS credit points can be earned. The grade for this module is determined by the weighted mean of the two exams according to: M = (5*PL1 + 2*PL2) / 7.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	2 semesters	