TECHNISCHE UNIVERSITÄT DRESDEN

Directory of Modules for Visiting Students *Diplom* Programme in Biomedical Engineering

Faculty of Electrical and Computer Engineering

Information Package for International Visiting and Exchange Students

August 2024

FAKULTÄT ELEKTROTECHNIK UND INFORMATIONSTECHNIK

Description

The Faculty of Electrical and Computer Engineering and the Faculty of Medicine Carl Gustav Carus at the Technische Universität Dresden offer the **Diplom degree programme in Biomedical Engineering.** 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 Biomedical Engineering 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).

Since the programme started in 2022 only, there is no offer from 7th-10th semester!

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**.

Content of the following module catalogue

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-BMT-C-GET	Basics of Electrical Engineering Grundlagen der Elektrotechnik	2/2/0 PL				German	**5**
EuI-BMT-C-Ma1	Introduction to Analysis and Algebra Algebraische und analytische Grundlagen	6/4/0 PL				German	**11**
EuI-BMT-C-GBMT	Fundamentals of Biomedical Engineering Grundlagen der Biomedizinischen Technik	4/0/0 1 hour per week seminar PL				German	**5**
EuI-BMT-C-PCG	Physico-chemical Fundamentals of Biomedical Engineering Physikalisch-chemische Grundlagen der Biomedizintechnik	2/0/0 2 hours per week seminar	2/0/0 1 hour per week seminar PL			German	**9**
EuI-BMT-C-EMF	Electric and Magnetic Fields Elektrische und magnetische Felder		2/2/0 PL			German	**5**
EuI-BMT-C-Ma2	Calculus for Functions with Several Variables Mehrdimensionale Differential- und Integralrechnung		4/4/0 PL			German	**9**
EuI-BMT-C-PGBMT	Practical Basics of Biomedical Engineering Praktische Grundlagen der Biomedizinischen Technik		0/0/2 1 hour per week seminar PL			German	**4**
EuI-BMT-C-TM	Engineering Mechanics Technische Mechanik		2/2/0 PL			German	**5**

EuI-BMT-C-GE	Electronic Systems Design Geräteentwicklung		2/2/0 PL			German	**5**
BMT-ET-01 04 03	Complex Function Theory Funktionentheorie			2/2/0 PL		German	**4**
BMT-22-G-11	Fundamentals of Radiation Physics Strahlenphysikalische Grundlagen			4/2/0 PL		German	**6**
BMT-ET-12 01 01	Microcomputer Technology Mikrorechentechnik			2/0/1	1/0/2 PL	German	**7 (3+4)**
BMT-ET-12 08 03	Dynamical Electrical Networks Dynamische Netzwerke			2/2/1 PL	0/0/2 PL	German	**8 (6+2)**
BMT-ET-12 09 01	Systems Theory Systemtheorie			2/1/0	2/2/0 PL	German	**7 (3+4)**
BMT-ET-13 00 01	Materials Science Werkstoffe			2/1/0 PL		German	**3**
BMT-22-G-15	Biomedical Technology in Clinical Use Biomedizinische Technik im Klinikeinsatz			3/0/0 1 hour per week seminars PL		German	**4**
BMT-ET-01 04 04	Partial Differential Equations and Probability Theory Partielle Differentialgleichungen und Wahr-scheinlichkeitstheorie				2/2/0 PL	German	**4**
BMT-ET-12 01 02	Automation Engineering and Measurement Automatisierungs- und Messtechnik				3/2/0 PL	German	**5**
BMT-ET-12 10 24	Communications Nachrichtentechnik				2/1/0 PL	German	**3**
BMT-22-G-16	Radiation Applications in Medicine Strahlenanwendungen in der Medizin				2/1/1 2 PL	German	**5**
BMT-ET-12 08 31	Electronic Circuits Schaltungstechnik				2/1/0 PL	German	**4**

Overview of the
Main studies modules 5th-6th 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**
BMT-22-P-10	Autonomous and Cooperative Systems in Biomedical Technology Autonome und Kooperative Systeme in der Medizin	4/0/1 1 hour per week seminars 2 PL		German	**7**
BMT-22-P-11	Biochemical Analysis Measurement Technology Biochemische Analysemesstechnik	3/0/1 2 PL		German	**5**
BMT-22-P-12	Medical Engineering Systems Medizintechnische Systeme	3/0/1 1 hour per week seminars 2 PL		German	**6**
BMT-22-P-16	Biosignal Processing Biosignalverarbeitung	4/0/1 1 hour per week seminars 2 PL		German	**7**
BMT-22-P-14	Introduction to Business Administration and Organization Einführung in die Betriebswirtschaftslehre und Organisation	3/1/0 1 hour per week tutorial PL		German	**5**
BMT-22-P-13	Digital Medical Technology Digitale Medizintechnik		4/2/0 PL	German	**7**
BMT-22-P-15	Medical Imaging and Processing Medizinische Bildgebung und -verarbeitung		2/0/1 1 hour per week seminars 2 PL	German	**6**

BMT-22-P-17	Computer Aided Design (CAD)		2/2/1 2 PL	German	**6**
BMT-22-P-18	Medical Device Development Medizingeräteentwicklung		4/0/0 PL	German	**5**

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

Module name	**Basics of Electrical Engineering**
Module number	EuI-BMT-C-GET (EuI-ET-C-GET, EuI-IST-C-GET, EuI-MT-C-GET, EuI-RES-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-BMT-C-Ma1 (EuI-ET-C-Ma1, EuI-IST-C-Ma1, EuI-MT-C-Ma1, EuI-RES-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	**Fundamentals of Biomedical Engineering**
Module number	EuI-BMT-C-GBMT
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg lehre.ibmt@tu-dresden.de
Objectives	After completing the module, students have a basic knowledge of anatomy and physiology and are familiar with the medical technology systems that are most frequently used in patient care. They know the functional principles and the requirements for such systems.
Contents	The contents of the module are the basics of anatomy, physiology and and pathology for engineers, in particular the central and periphe- nervous system, cardiopulmonary system and regulation, urinary system, digestive system, sensory organs, musculoskeletal system and the basics of biomedical technology, in particular diagnostic and therapeutic systems of the cardiovascular systems, respiratory technology, intensive care technology, medical imaging procedures, surgical techniques, sleep medicine technology and monitoring systems, biomechanics and orthopaedic technology and the latest developments.
Modes of teaching and learning	4 hours per week lectures, 1 hour per week seminars and self-study.
Prerequisites	Knowledge of mathematics, physics, chemistry and biology at basic A-level is required.
Usability	The module is a compulsory module in the basic studies of the degree programme Biomedical 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 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	**Physico-chemical Fundamentals of Biomedical Engineering**
Module number	EuI-BMT-C-PCG
Lecturer in charge	PD Dr. rer. medic. habil. Julia Walther julia.walther@tu-dresden.de
Objectives	After completing the module, the students are familiar with the fundamentals of chemistry and physics that are important for medical technology. They know the essential laws of physics and the basics of the mathematical description of physical processes. They have knowledge of the important facts in mechanics, acoustics, thermodynamics and optics. They have a basic knowledge of general, inorganic, organic and analytical chemistry. Further, they have basic chemical knowledge of materials science.
Contents	The contents of the module are the basics of chemistry and physics and its application in biomedical technology. The module includes physical principles of imaging technologies in medicine, optics in the context of optical medical technology, bio-physical control circuits, important classes of substances in physiological and medical chemistry and chemical reaction types.
Modes of teaching and learning	4 hours per week lectures, 3 hours per week seminars and self-study.
Prerequisites	Knowledge of mathematics, chemistry and physics at basic A-level is required. Literature: Axel Zeeck, Sabine Cécile Zeeck, Stephanie Grond: Chemie für Mediziner; Hering, Martin, Stohrer: Physik für Ingenieure.
Usability	The module is a compulsory module in the basic studies of the degree programme Biomedical 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 120 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 academic year beginning in the winter semester.
Workload	The total effort is 270 hours.
Duration	The module takes two semesters.

Module name	**Electric and Magnetic Fields**
Module number	EuI-BMT-C-EMF (EuI-ET-C-EMF, EuI-IST-C-EMF, EuI-MT-C-EMF, EuI-RES-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-BMT-C-Ma2 (EuI-ET-C-Ma2, EuI-IST-C-Ma2, EuI-MT-C-Ma2, EuI-RES-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	**Practical Basics of Biomedical Engineering**
Module number	EuI-BMT-C-PGBMT
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg lehre.ibmt@tu-dresden.de
Objectives	After completing the module, students have in-depth basic knowledge of anatomy and physiology and are familiar with the medical technology systems most commonly used in patient care. From their own practical work and demonstrations they are familiar with the functional principles of medical technology procedures in various clinical areas.
Contents	The contents of the module are the basics of physiological measurement technology and in-depth physiological-anatomical basic knowledge, in particular blood pressure, cardiac excitation, cardiac sound and circulation, evoked potentials, ergometric stress, respiration and respiratory sinus arrhythmia, muscle stimulation and fatigue, reflexes and reaction tests as well as medical terminology, in particular terms and processes in the body and during treatment and introduction to the history of medicine and medical technology.
Modes of teaching and learning	1 hour per week seminars, 2 hours per week practical lab course and self-study.
Prerequisites	Knowledge of mathematics, physics, chemistry and biology at basic A-level is expected. In addition, the knowledge acquired in the module Fundamentals of Biomedical Engineering is a prerequisite.
Usability	The module is a compulsory module in the basic studies of the degree programme Biomedical 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 portfolio of 60 hours.
Credit points and grades	4 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 120 hours.
Duration	The module takes one semester.

Module name	**Engineering Mechanics**
Module number	EuI-BMT-C-TM (EuI-ET-E-TM, EuI-MT-C-TM, EuI-RES-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-BMT-C-GE (EuI-ET-C-GE, EuI-MT-C-GE, EuI-RES-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 number	Module name	Lecturer in charge
BMT-ET-01 04 03	Complex Function Theory	Prof. Dr. rer. nat. habil. Z. Sasvári
Contents and objectives	Content of the module is the function theory with the main focus on differentiation, integration, series development and conformal transformation. Outcomes: The students have knowledge of functions with complex variables.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competencies acquired in modules such as Introduction to Analysis and Algebra, Calculus for Functions with Several Variables 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 of 120 minutes.	
ECTS credit points and grades	4 ECTS credit points The module grade is the grade of the exam.	
Frequency	Annually, in the winter semester	
Workload	120 hours	
Duration	1 semester	

Module name	**Fundamentals of Radiation Physics**
Module number	BMT-22-G-11
Lecturer in charge	Prof. Dr. Christian Richter christian.richter@oncoray.de
Objectives	After completing the module, students are familiar with the basics of atomic, nuclear and radiation physics relevant to the application of radiation in medicine and radiation protection. They have the theoretical and methodological skills to independently solve practical tasks relating to the therapeutic and diagnostic use of radionuclides, dosimetry and detection of ionizing radiation and radiation protection.
Contents	The contents of the module are the atomic, nuclear and radiation-physical fundamentals for the application of radiation in medicine. This includes atomic and nuclear physical laws that are relevant for therapeutic and diagnostic applications of radionuclides and the generation of ionizing radiation through atomic and nuclear processes: Fundamentals of quantum mechanics and special relativity; atomic shell: construction and radiation emission; atomic nucleus: phenomenological properties and nuclear models; nuclear magnetic moments; decay of unstable nuclei; nuclear nuclei; nuclear reactions. This includes the basic processes of interaction between radiation and matter, which are relevant for therapeutic and diagnostic applications of ionizing radiation and for radiation protection, in detail: radiation field quantities and radiation transport equation, energy transfer in the radiation field, effects as a result of energy transfer, biological radiation effects.
Modes of teaching and learning	4 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The module requires knowledge of classical physics and advanced mathematics at basic A-level. The knowledge acquired in the **modules Introduction to Analysis** and **Calculus for Functions with Several Variables** is required.
Usability	The module is a compulsory module in the basic studies of the degree programme Biomedical 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 180 minutes.
Credit points and grades	6 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 180 hours.
Duration	The module takes one semester.

Module number	Module name	Lecturer in charge
BMT-ET-12 01 01	Microcomputer Technology	Prof. Dr.-Ing Frank Fitzek
Contents and objectives	Contents of the module are computer architecture and instruction set architecture, coupling with technical processes; instruction set oriented programming (assembler); efficient and portable programming of data structures and algorithms in a typical based procedural language (eg C) as well as object-oriented analysis, design and generic implementation of data structures and algorithms using examples of electrical engineering and information technology (eg C ++).	
Modes of teaching and learning	3 hours per week lectures, 3 hours per week practical lab courses, and self-study.	
Prerequisites	Competencies acquired in modules such as Computer Science.	
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 practical lab course.	
ECTS credit points and grades	7 ECTS credit points The module grade is the grade of the module assessment.	
Frequency	Annually, beginning in the winter semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
BMT-ET-12 08 03	Dynamical Electrical Networks	Prof. Dr. phil. nat. habil. Ronald Tetzlaff
Contents and objectives	The module contents: the analysis of linear dynamic networks. Outcomes: After completing this module, students are able to apply methods for analyzing linear dynamic circuits excited by periodic signals and to determine the transient behavior between stationary states. They are able to describe, to model and to analyze linear two-ports. They can determine transfer functions, analyze and graphically represent the network behavior for different frequencies, and determine basic filter structures. Phasor representations and Nyquist plots are mastered.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorial, 3 hours per week practical lab course, and self-study.	
Prerequisites	Knowledge acquired in modules such as **Basics of Electrical Engineering**, or equivalent. The prerequisites for participation in the lab course is to pass the module exam of the module **Basics of Electrical Engineering**.	
Requirements for the award of ECTS credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of a written exam of 150 minutes and a lab course. Both assessments must be passed.	
ECTS credit points and grades	8 ECTS credit points can be earned. The module grade is determined by the weighted average of the grades of both elements of assessment. The module grade consists to 2/3 of the grade of the written exam and to 1/3 of the lab course grade.	
Frequency	annually, starting in the winter semester	
Workload	240 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
BMT-ET-12 09 01	Systems Theory	Prof. Dr.-Ing. Rafael F. Schaefer rafael.schaefer@tu-dresden.de
Contents and objectives	Content: The module deals with the fundamentals of systems theory with focus on digital systems, analogue time-continuous systems, analogue time-discrete systems and selected applications. Objectives: Having successfully completed the module, the students are familiar with the regulative significance of the system concept in engineering. They master the application of signal transformations for the effective description of the system behaviour in the area of image. In particular, they are able to apply the approach of system theory to important areas of their own discipline, e.g. to the calculation of electrical networks in the case of non-sinusoidal or stochastic excitation and to the realization of systems with desired transfer behaviour in time-discrete form (digital filter).	
Modes of teaching and learning	4 hours per week lectures and 3 hours per week exercises and self-study	
Prerequisites	Competences acquired in modules such as **Introduction to Analysis and Algebra,** **Calculus for Functions with Several Variables,** **Basics of Electrical Engineering**, or equivalent.	
Requirements for the award of ECTS credit points	The ECTS credit points are awarded when the module assessment is passed. The module assessment is a written exam of 120 minutes.	
ECTS credit points and grades	7 ECTS credit points The module grade is the grade of the written exam.	
Frequency	Annually, beginning in the winter semester	
Workload	210 hours	
Duration	2 semesters	

Module name	**Materials Science**
Module number	BMT-ET-13 00 01 (EuI-ET-C-Wrkst, EuI-MT-C-Wrkst, EuI-RES-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	**Biomedical Technology in Clinical Use**
Module number	BMT-22-G-15
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg Lehre.IBMT@tu-dresden.de
Objectives	After completing the module, students will have knowledge of the use of medical technology procedures in clinical routine. They know the organizational principles and procedures in the treatment of selected diseases and will be able to organize the organizational processes in a clinic.
Contents	The content of the module is medical technology in clinical application, in particular the overview of procedures and processes in the clinical routine in various medical disciplines, quality assurance and the organization of the healthcare system.
Modes of teaching and learning	3 hours per week lectures, 1 hour per week seminars and self-study.
Prerequisites	The knowledge acquired in the modules **Fundamentals of Biomedical Engineering** and **Practical Principles of Biomedical Engineering** are required.
Usability	The module is a compulsory module in the basic studies of the degree programme Biomedical 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 60 minutes.
Credit points and grades	4 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 120 hours.
Duration	The module takes one semester.

Module number	Module name	Lecturer in charge
BMT-ET-01 04 04	Partial Differential Equations and Probability Theory	Prof. Dr. rer. nat. habil. Z. Sasvári
Contents and objectives	The content of the module focuses on partial differential equations and probability theory. Outcomes: After completion of the module, the students have knowledge of special analytical solution methods of partial differential equations and probability theory.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, and self-study.	
Prerequisites	Competencies acquired in modules such as Introduction to Analysis and Algebra, Calculus for Functions with Several Variables 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 of 120 minutes.	
ECTS credit points and grades	4 ECTS credit points The module grade is the grade of the exam.	
Frequency	Annually, in the summer semester	
Workload	120 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
BMT-ET-12 01 02	Automation Engineering and Measurement	Prof. Dr. techn. K. Janschek
Contents and objectives	Content: 1. Fundamentals of automation engineering wit the focus on behavioural description, control design in the frequency domain, digital control loops, industrial standard controllers, discrete-event control systems, elementary control concepts and automation technologies 2. Fundamentals of measuring with the focus on measurement principles, SI units, analogue measurement technology (fundamentals, measurement bridges, lock-in measurement technique, quadrature demodulation technique, measurement of transit times and distances) and statistical measurement data evaluation (calculation of standard deviation and confidence intervals, propagation of the measurement uncertainty, setup of uncertainty budget for measurement) Objectives: Having successfully completed the modules, the students 1. understand fundamental behaviour description forms for technical systems. Further, they master the basic theoretical and computer-aided handling of linear, time-invariant and discrete-event behaviour models for the control of technical systems. They are able to design control algorithms for simple tasks. 2. are familiar with the principles of analogue measuring procedures and are able to evaluate measurement results by using statistical methods. They are able to calculate and interpret random and systematic measuring uncertainties.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorial, and self-study	
Prerequisites	Competences acquired in basic modules on Physics.	
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 test of 210 minutes.	
ECTS credit points and grades	5 ECTS credit points The module grade is the grade of the written exam.	
Frequency	annually, in the summer semester	

Workload	150 working hours
Duration	1 semester

Module number	Module name	Lecturer in charge
BMT-ET-12 10 24	Communications	Prof. Dr.-Ing. Dr. h. c. G. Fettweis
Course contents and intended learning outcomes	The module includes: Signal theory (sine waves, Dirac function, convolution, Fourier transform), linear time-invariant systems (transfer function, impulse response), bandpass signals (real and complex up and down mixing of signals, equivalent lowpass signal), analogue modulation (modulation, demodulation, properties of AM, PM, FM), analogue-digital conversion (sampling, signal reconstruction, quantization, sub- and oversampling), digital modulation schemes (modulation methods, matched-filter receiver, bit error probability). Outcomes: After completing this module, the students master the basic principles and the practical application of communications engineering. The students will be able to understand the basic signal processing in communications systems and to describe them mathematically. They are familiar with the transmission in base-band and band-pass area and know the basic analogue and digital modulation methods. They understand the impact of noise on the transmission quality for simple analogue and digital transmission scenarios.	
Teaching methods	2 hours per week lectures, 1 hour per week tutorial, and self-study.	
Required previous knowledge	Competences provided in modules such as **Introduction to Analysis and Algebra,** **Calculus for Functions with Several Variables,** **Complex Function Theory,** **Systems Theory** (1st semester of module), 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.	
ECTS credit points and grades	3 ECTS credit points The module grade is the grade of the written exam.	
Frequency	Annually, in the summer semester	
Workload	90 hours	
Duration	1 semester	

Module name	**Radiation Applications in Medicine**
Module number	BMT-22-G-16
Lecturer in charge	Prof. Dr. Christian Richter christian.richter@oncoray.de
Objectives	After completing the module, students have basic knowledge of the different types of radiation applications in clinical routine. They know the basic principles of action, technologies and treatment procedures. This enables them to classify and assign technologies.
Contents	The module covers radiation applications in medicine in terms of basic physical principles, technical implementation and medical benefits, in particular radiological diagnostics including X-rays, computed tomography, magnetic resonance imaging, nuclear medicine including principles, imaging diagnostics and therapy with open radionuclides and radiotherapy, for example internal and external radiation therapy: overview Brachytherapy and teletherapy with various radiation sources, basic radiation techniques.
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	The competencies to be acquired in the module **Fundamentals of Radiation Physics** are required.
Usability	The module is a compulsory module in the basic studies of the degree programme Biomedical 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 and a term paper of 10 hours.
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 2/3 and the term paper is weighted by 1/3.
Frequency	The module is offered every summer semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module number	Module name	Lecturer in charge
ET-12 08 31	Electronic Circuits	Prof. Dr. sc. techn. habil. F. Ellinger
Contents and objectives	This module gives an introduction to electronic circuits, such as basic analogue circuits, differential amplifiers, power amplifiers, operational amplifiers and its applications, power supply, basic digital circuits, combinational und sequential logic. Students learn fundamental principles and practical realisations of analogue and digital circuits. They understand the properties of these circuits using different structures and the properties of the electronic devices. They can handle the methods of circuit analysis and they can dimension the circuits for specific applications.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week exercises, and self-study	
Prerequisites	Competences acquired in modules such as **Introduction to Analysis and Algebra,** **Calculus for Functions with Several Variables,** **Basics of Electrical Engineering,** **Microelectronic Technologies and Devices**, 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 The module grade is the grade of the written exam.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module descriptions
Main studies modules 5th-6th semester
(relevant for all specialization areas)

Module name	**Autonomous and Cooperative Systems in Biomedical Technology**
Module number	BMT-22-P-10 / EuI-BMT-C-AKSM
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg Lehre.IBMT@tu-dresden.de
Objectives	After completing the module, students will have knowledge, skills and abilities in dealing with autonomous and cooperative systems in medicine. They know the functional principles and methodological tools for developing such systems.
Contents	The contents of the module are networked and intelligent implants, including introduction to implant technology, functional implants, getting to know integrated sensor technology and clinical applications, generalization of measurement, automation and analysis tasks, structure and design of intelligent and networked implants, including energy supply, biocompatible assembly and connection technology, interfaces, cardiac assistance systems, including therapy concept, functionality, pacemaker codes, assembly and application of pacemakers and defibrillators, frequency-adaptive systems, telemonitoring, safety, biomechanical systems in rehabilitation, including introduction to posture and movement analysis, biomechanical systems in rehabilitation, including introduction to posture and movement analysis, biomechanical measurement methods, instrumental gait analysis, therapy concepts for prostheses, orthoses and exoskeletons.
Modes of teaching and learning	4 hours per week lectures, 1 hour per week seminars, 1 hour per week practical lab courses and self-study.
Prerequisites	The knowledge acquired in the modules **Physico-chemical Fundamentals of Biomedical Engineering** and **Fundamentals of Biomedical Engineering** are required.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 and a complex exam of 30 hours. Both exams have to be passed.

Credit points and grades	7 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 3/4 and the complex exam is weighted by 1/4.
Frequency	The module is offered every winter semester.
Workload	The total effort is 210 hours.
Duration	The module takes one semester.

Module name	**Biochemical Analysis Measurement Technology**
Module number	BMT-22-P-11 / EuI-BMT-C-BCAMT
Lecturer in charge	Prof. Dr.-Ing. habil. Uwe Marschner uwe.marschner@tu-dresden.de
Objectives	After completing the module, students have knowledge, skills and abilities in cell and molecular biology as well as in clinical laboratory and analytical measurement technology.
Contents	The module covers all essential topics in which living and non-living substances interact through their biochemical properties. Particular emphasis is placed on cell and molecular biology fundamentals, including nucleic acids, amino acids, proteins, vitamins, enzymes, basic cellular processes and their analysis. Special applications are dealt with in particular in clinical laboratory and analytical measurement technology, which are used in routine clinical practice.
Modes of teaching and learning	3 hours per week lectures, 1 hour per week practical lab courses and self-study.
Prerequisites	The knowledge acquired in the modules **Physico-chemical Fundamentals of Biomedical Engineering** and **Fundamentals of Biomedical Engineering** are required.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 120 minutes and a portfolio of 50 hours. Both exam and portfolio 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 3/4 and the portfolio is weighted by 1/4.
Frequency	The module is offered every winter semester.
Workload	The total effort is 150 hours.
Duration	The module takes one semester.

Module name	**Medical Engineering Systems**
Module number	BMT-22-P-12 / EuI-BMT-C-MTS
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg Lehre.IBMT@tu-dresden.de
Objectives	After completing the module, students will be able to classify medical technology procedures and systems in a clinical environment. Furthermore, they have basic knowledge of regulatory requirements along the life cycle of medical devices. They will be able to independently solve tasks in the application and development of medical technology in the training process.
Contents	The module covers the basic principles of medical measurement and sensor technology, therapeutic systems technology, in particular electromedical systems, detoxification, infusion technology and cardioassist systems. Based on medical questions and problems, technical solutions in the form of medical devices are considered. The content includes selected organ systems, such as the cardiovascular system, urinary system, respiratory system and nervous and muscular systems. Further, the content includes the basic legal requirements such as the Medical Device Regulation (MDR) and normative requirements for the development process of medical devices and their manufacture and monitoring.
Modes of teaching and learning	3 hours per week lectures, 1 hours per week seminars, 1 hour per week practical lab courses and self-study.
Prerequisites	The knowledge acquired in the modules **Physico-chemical Fundamentals of Biomedical Engineering, Basics of Electrical Engineering, Fundamentals of Biomedical Engineering** and **Practical Basics of Biomedical Engineering** are required.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 and a complex exam of 30 hours. Both exams have to be passed.
Credit points and grades	6 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 3/4 and the complex exam is weighted by 1/4.
Frequency	The module is offered every winter semester.

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

Module name	**Biosignal Processing**
Module number	BMT-22-P-16 / EuI-BMT-C-BSV
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg Lehre.IBMT@tu-dresden.de
Objectives	After completing the module, students will have knowledge, skills and abilities for IT-supported analysis of physiological signals. They are familiar with the functional principles and methodological tools for developing such systems.
Contents	The contents of the module are the basics of signal processing, in particular digital filtering, signal analysis in the frequency domain, including time-frequency analysis, transformations, linear prediction and methods for dimensional reduction; special biosignal processing, in particular the medical signal processing chain, artifact handling and principal component analysis, biosignal analysis in the time domain, biosignal analysis with non-linear and knowledge-based methods, medical statistics and study planning as well as the application of artificial intelligence in biomedical engineering, in particular knowledge-based systems and artificial neural networks.
Modes of teaching and learning	4 hours per week lectures, 1 hour per week seminars, 1 hour per week practical lab courses and self-study.
Prerequisites	The knowledge acquired in the modules **Fundamentals of Biomedical Engineering** and **Systems Theory** are required.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 120 minutes and a complex exam of 25 hours.
Credit points and grades	7 credit points can be obtained by the module. The module grade is the unweighted mean of the grades of the assessments.
Frequency	The module is offered every winter semester.
Workload	The total effort is 210 hours.
Duration	The module takes one semester.

Module name	**Introduction to Business Administration and Organization**
Module number	BMT-22-P-14 / EuI-BMT-C-EBWL (EuI-ET-E-EBWL, EuI-IST-E-EBWL, EuI-MT-E-EBWL, EuI-RES-E-EBWL)
Lecturer in charge	Prof. Dr. Michael Schefczyk info@gruenderlehrstuhl.de
Objectives	Students have basic knowledge of the concepts and principles of business administration and the fundamentals of organizational management. They have the methodological tools and systematic orientation. Students are able to successfully deal with business management issues, recognize problems of organizational management and assess the effectiveness of organizational design measures.
Contents	The module covers the basics of business administration, in particular legal forms, marketing, innovations and property rights, technology management, production and procurement, service management, investment and financing, project management, controlling, theories of organizational design, models of organizational differentiation, models of organizational integration, formal and informal organization, motivational organizational design, organizational culture, organizational change and ethical behaviour in organizations.
Modes of teaching and learning	3 hours per week lectures, 1 hour per week exercises, 1 hour per week tutorials and self-study.
Prerequisites	There are no special prerequisites.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical Engineering. Further, it is a compulsory elective module from the compulsory elective area of General Qualifications according to § 6 paragraph 3 SO and § 33 paragraph 3 PO of the main studies in the diploma study programme Information Systems Technology, Mechatronics and Renewable Energy Systems. Furthermore, it is a compulsory elective module from the compulsory elective area General Qualifications according to § 6 paragraph 3 SO and § 33 paragraph 5 PO of the main studies in the diploma study programme 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 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	**Digital Medical Technology**
Module number	BMT-22-P-13 / EuI-BMT-C-DMT
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg Lehre.IBMT@tu-dresden.de
Objectives	After completing the module, students will have the knowledge, skills and abilities to use modern medical diagnostic systems. They know the functional principles and methodological tools for developing such systems. In addition, students know and understand the basic structures, concepts and algorithms of machine learning and deep learning as well as their typical areas of application. They will be able to design, train and validate artificial neural networks for specific problems using the latest software.
Contents	The contents of the module are biosignals and monitoring as well as an introduction to machine learning. The focus on biosignals and monitoring covers in particular the recording of body signals, including bioelectrical, biophysical, auxiliary energy and its properties, measurement methods for lung diagnostics, orthopaedics, sensory organs; clinical laboratory and analysis measurement technology, contactless medical measurement methods, telemedicine and mobile diagnostic systems. The focus on introduction to machine learning includes an overview of basic structures, concepts and algorithms of machine learning and deep learning, including application-related design, classification and training methods. This covers in particular the discussion of typical and current problems and application areas of machine learning and their critical evaluation as well as practical experience in the design and training of artificial neural networks for various application areas using current software libraries.
Modes of teaching and learning	4 hours per week lectures, 2 hours per week exercises and self-study.
Prerequisites	The knowledge acquired in the modules **Fundamentals of Biomedical Engineering** and **Systems Theory** are required. Basic knowledge of linear algebra and analysis as well as basic programming skills are required, which can be acquired in the modules **Introduction to Analysis and Algebra, Calculus for Functions with Several Variables and Software Engineering Basics**.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 portfolio of 45 hours.

Credit points and grades	7 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 210 hours.
Duration	The module takes one semester.

Module name	**Medical Imaging and Processing**
Module number	BMT-22-P-15 / EuI-BMT-C-MBGV
Lecturer in charge	Prof. Dr.-Ing. habil. Hagen Malberg Lehre.IBMT@tu-dresden.de
Objectives	After completing the module, students will have a working knowledge of imaging modalities and their technical implementation and will have skills in the use of image processing software and spatial presentation and interaction tools in the medical and engineering fields. They are able to develop individual components.
Contents	The contents of the module are imaging procedures and devices in medicine, in particular the principles of operation and technical realization of devices and procedures in the medical diagnostic process, such as X-ray diagnostics, CT, MRI, PET, SPECT, US, multimodal data fusion, visualization and quality assessment of diagnostic procedure as a basis for the medical decision-making process and therapeutic measures. Further, the content includes medical image processing, in particular mathematical algorithms for medical image processing and visualization of spatial data, data formats and models of volume data massifs, autostereoscopic presentation and 3D interaction and training in the handling of real multidimensional medical data and images using various software systems.
Modes of teaching and learning	2 hours per week lectures, 1 hour per week seminars, 1 hour per week practical lab course and self-study.
Prerequisites	The knowledge acquired in the modules **Physico-chemical Fundamentals of Biomedical Engineering** and **Radiation Applications in Medicine** are required.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 and a complex exam of 30 hours. Both exams have to be passed.
Credit points and grades	6 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 2/3 and the complex exam is weighted by 1/3.
Frequency	The module is offered every summer semester.
Workload	The total effort is 180 hours.

Duration	The module takes one semester.

Module name	**Computer Aided Design (CAD)**
Module number	BMT-22-P-17 / EuI-BMT-C-CAD
Lecturer in charge	Prof. Dr.-Ing. habil. Jens Lienig jens.lienig@tu-dresden.de
Objectives	After completing the module, students will be able to create standardized design documentation for medical assemblies and electronic wiring carriers using modern CAD systems. They know the methodology of computer-aided mechanical and electronic design based on commercial design tools.
Contents	The content of the module covers both computer-aided computer-aided design in both mechanics and electronics. The focus in the CAD design of mechanical components is on the components on the methodology for creating CAD models, modeling assemblies, parametric and adaptive design as well as motion and tolerance simulation. The computer-aided design of electronic wiring carriers includes design steps, library concepts, interfaces as well as objectives and constraints in layout design.
Modes of teaching and learning	2 hours per week lectures, 2 hours per week exercises, 1 hour per week practical lab course and self-study.
Prerequisites	The knowledge acquired in the module **Electronic Systems Design** is required.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 60 minutes and a portfolio of 50 hours. Both exam and portfolio have to be passed.
Credit points and grades	6 credit points can be obtained by the module. The module grade is the unweighted mean of the grades of the assessments.
Frequency	The module is offered every summer semester.
Workload	The total effort is 180 hours.
Duration	The module takes one semester.

Module name	**Medical Device Development**
Module number	BMT-22-P-18 / EuI-BMT-C-MGE
Lecturer in charge	Prof. Dr.-Ing. habil. Jens Lienig jens.lienig@tu-dresden.de
Objectives	After completing the module, students have the skills and abilities to develop medical device technology products. They are able to proceed systematically according to the rules of the general constructive development process with the aim of offering innovative solutions in the area of conflicting economic aspects, patent situation, conflicting requirements, environment and production They will be familiar with the most important actuator principles for medical devices and their design. With their knowledge of the specific properties of the actuators, they select them accurately according to the requirements.
Contents	The module covers the basics of product development, including the systematic solution of design tasks, product development methods, the constructive development process, creativity techniques for finding solutions, quality assurance during product development and advanced fields of thought for product developers. On the other hand, the module covers relevant actuators for medical device technology, with a focus on the structure of drive systems, operating behavior, calculations, control and operation of classic and smart actuators.
Modes of teaching and learning	4 hours per week lectures and self-study.
Prerequisites	The knowledge acquired in the module **Electronic Systems Design** is required.
Usability	The module is a compulsory module in the main studies of the degree programme Biomedical 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 180 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.