TECHNISCHE UNIVERSITÄT DRESDEN

Directory of Modules for Visiting Students *Diplom* Programme in Information Systems Engineering

Faculty of Electrical and Computer Engineering

Information Package for International Visiting and Exchange Students

February 2022

FAKULTÄT ELEKTROTECHNIK UND INFORMATIONSTECHNIK

Description

The Faculty of Electrical and Computer Engineering and the Faculty of Computer Science at the Technische Universität Dresden offer the Diplom degree **programme in Information Systems 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 Information Systems 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).

The programme **comes in modules**. Each module **consists of 1, 2, 3 or 4 parts, i.e. courses**. Mostly the courses' 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!

In the following catalogue you will find
- the **modules of our basic studies**, see here
- the **modules of the main studies**, see here.

Language of instruction

The study programme is held in **German**, however, a few modules are taught in English, too. Students who apply for this study programme should have **German language skills** of at least **B1**.

Specialization areas

Within the **main studies, there are 5 specialization areas**:
- Automation / Automatisierung
- Electronic Circuits and Systems / Elekrische Schaltungen und Systeme
- Communication Technology / Kommunikationstechnik
- Microelectronics / Mikroelektronik
- Computer Science / Informatik

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 – click here
2. **Overview of the main studies modules**, 5th-10th semester, all specializations – click here
   - Specialization *Automation* – click here
   - Specialization *Electronic Circuits and Systems* – click here
   - Specialization *Communication Technology* – click here
   - Specialization *Microelectronics* – click here
   - Specialization *Computer Science* click here

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.

Please make sure that you visit the whole module!

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 is the 10th semester not indicated?

In the 10th semester the students write their final thesis.

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
- T means tutorial
- 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 tutorial (90 minutes exercise 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 tutorial 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, tutorial 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**
ET-01 04 01	Introduction to Analysis and Algebra Algebraische und analytische Grundlagen	6/4/0 PL				German	**11**
ET-01 04 02	Calculus for Functions with Several Variables Mehrdimensionale Differential- und Integralrechnung		4/4/0 PL			German	**9**
ET-01 04 03	Complex Function Theory Funktionentheorie			2/2/0 PL		German	**4**
ET-01 04 04	Partial Differential Equations and Probability Theory Partielle Differentialgleichungen und Wahr-scheinlichkeitstheorie				2/2/0 PL	German	**4**
ET-01 04 05	Algebra Algebra	1/1/0	1/1/0 PL			German	**6**
INF-D-210	Algorithms and Data Structures Algorithmen und Datenstrukturen	2/2/0 PL				German	**5**
INF-B-230	Introduction project RoboLab Einführungspraktikum RoboLab	0/0/4 PL				German	**4**
INF-B-240	Programming Programmierung		2/2/0 PL			German	**6**
INF-B-310	Software Technology Softwaretechnologie		2/2/0 PL			German	**6**
INF-B-320	Software Technology project Softwaretechnologie-Projekt			0/0/4 PL		German	**6**
INF-B-330	Computer Architecture Rechnerarchitektur			2/2/0	2/2/0 PL	German	**10**
INF-D-425	Hardware Laboratory Hardwarepraktikum				0/0/3 PL	German	**3**
ET-12 08 01	Fundamentals of Electrical Engineering Grundlagen der Elektrotechnik	2/2/0 PL				German	**6**

ET-12 08 02	Electric and Magnetic Fields Elektrische und magnetische Felder		4/2/0 PL			German	**6**
ET-12 08 03	Dynamical Electrical Networks Dynamische Netzwerke			2/2/1 PL	0/0/2 PL	German	**8**
ET-12 08 31	Electronic Circuits Schaltungstechnik				4/2/0 PL	German	**7**
ET-12 09 10	System Theorie and Automation Engineering Systemtheorie und Automatisierungstechnik			2/1/0	4/3/0 2 PL	German	**10**
ET-12 08 11	Microelectronic Technologies and Devices Technologien und Bauelemente der Mikroelektronik			5/1/0 PL		German	**6**

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**
ET-12 08 33	Digital Circuit Design Digitale Schaltungstechnik	2/1/0 PL		German	**3**
INF-B-275	Theory and Applications of Formal Systems Theorie und Anwendung formaler Systeme	4/2/0 PL	2/0/0 PL	German	**10**
INF-B-370	Databases/Computer Networks Datenbanken und Rechnernetze		4/4/0 2 PL	German	**10**
INF-B-380	Operating Systems and Security Betriebssysteme und Sicherheit	4/2/0 PL		German	**7**
ET-12 08 18	Integrated Circuit Design Schaltkreis- und Systementwurf	2/1/0	0/0/2 2 PL	German	**7**
ET-12 10 27	Signal Processing and Information Theory Signalverarbeitung und Informationstheorie	2/1/0	2/2/0 2 PL	German	**7**
ET-12 10 24	Communications Nachrichtentechnik		2/1/0 PL	German	**3**

Overview of the
Main studies modules 5th-10th semester
In the specialization area: **Automation**

Module number, with link to description	**Module name** English German	**6th summer semester** L/T/P	**7th winter semester** L/T/P	**Language of instruction**	**ECTS Credits**
ET-12 01 10	Industrial Automation Engineering 1 Industrielle Automatisierungstechnik – Basismodul	3/1/0 PL	0/0/2 PL	German	**7**
ET-12 01 21	Project Planning for Process Automation Systems Projektierung von Automatisierungssystemen	2/2/2 2 PL		German/ English	**7**
ET-12 01 11	Industrial Automation Engineering 2 Industrielle Automatisierungstechnik – Aufbaumodul	3/2/1 2 PL		German/ English	**7**
ET-12 01 12	Robotics Robotik	2/1/0 PL	2/1/1 2 PL	German	**7**
ET-12 01 13	Systems Design Systementwurf		4/2/0 2 PL	German	**7**
ET-12 13 11	Nonlinear Control Systems, Advanced Nichtlineare Regelungssysteme – Vertiefung	2/0/0 PL	2/1/0 PL	German	**7**
ET-12 13 12	Optimal and Robust Multivariable Control Systems Optimale, robuste und Mehrgrößenregelung	2/0/0 PL	2/1/0 PL	German	**7**
ET-12 01 20	Human Machine System Technology Mensch-Maschine-Systemtechnik		2/2/2 2 PL	German	**7**
ET-12 01 22	Process Management Systems Prozessführungssysteme	1/1/0 PL	1/1/2 2 PL	German	**7**
IST-W-22-DLMST	Digital Laser Measurement Technology Digitale Lasermesstechnik	4/1/1 2 PL		German	**7**

Overview of the
Main studies modules 5th-10th semester
In the specialization area: **Electronic Circuits and Systems**

Module number, with link to description	**Module name** English German	**6th semester summer semester** L/T/P	**7th semester winter semester** L/T/P	**Language of instruction**	**ECTS Credits**
ET-12 08 19	VLSI Processor Design VLSI-Prozessorentwurf	2/2/2 2 PL		English	**7**
ET-12 08 16	Radio Frequency Integrated Circuits	3/1/2 PL		English	**7**
ET-12 08 17	Integrated Circuits for Broadband Optical Communications		3/1/2 PL	English	**7**
ET-12 10 16	Digital Signal Processing and Hardware Implementation Digitale Signalverarbeitung und Hardware-Implementierung	2/1/0 PL	0/0/2 PL	German/ English	**7**
ET-12 08 07	Introduction to the Theory of Nonlinear Systems Einführung in die Theorie nichtlinearer Systeme	2/1/0 PL	2/1/0 PL	German/ English	**7**
ET-12 08 08	Circuit Simulation and System Identification Schaltungssimulation und Systemidentifikation	1/1/0 PL	2/1/0 PL	German	**7**
ET-12 08 27	Neuromorphic VLSI Systems Neuromorphe VLSI Systeme	4/2/0 2 PL		German	**7**

Overview of the
Main studies modules 5th-10th semester
In the specialization area: **Communication**

Module number, with link to description	**Module name** English German	**6th semester summer semester** L/T/P	**7th semester winter semester** L/T/P	**Language of instruction**	**ECTS Credits**
ET-12 09 08	Room Acoustics / Virtual Reality Raumakustik / Virtuelle Realität	4/0/2 2 PL		German	**7**
ET-12 10 05	Communication Networks, Advanced I Kommunikationsnetze, Aufbaumodul	4/2/0 2 PL		German	**7**
ET-12 10 09	Information Theory, Advanced I Aufbaumodul Informationstheorie		4/2/0 2 PL	German or English	**7**
ET-12 10 21	Network Coding: Theory and Practice Netzwerkkodierung in Theorie und Praxis	4/2/0 2 PL		German or English	**7**
ET-12 10 16	Digital Signal Processing and Hardware Implementation Digitale Signalverarbeitung und Hardware-Implementierung	2/1/0 PL	0/0/2 PL	German/ English	**7**
ET-12 09 13	Applied Intelligent Signal Processing Angewandte intelligente Signalverarbeitung	4/1/1 PL		German	**7**
ET-12 09 04	Speech Technology Sprachtechnologie		4/0/2 PL	German	**7**
ET-12 09 09	Psychoacoustics / Sound Design Psychoakustik / Sound Design		4/2/0 2 PL	German	**7**
ET-12 10 20	Communication Networks, Advanced II (Communication Networks 3) Kommunikationsnetze, Vertiefungsmodul		4/2/0 2 PL	English	**7**
ET-12 10 22	Cooperative Communications Kooperative Kommunikation	4/2/0 2 PL		German or English	**7**
ET-12 10 19	Optimization in modern Communication Systems Optimierung in modernen Kommunikationssystemen		4/2/0 2 PL	German or English	**7**

ET-12 10 13	RF Systems Hochfrequenzsysteme	4/2/0 PL		German	**7**
ET-12 10 15	Basics Mobile Communications Systems Grundlagen mobiler Nachrichtensysteme	4/2/0 PL		German	**7**
ET-12 10 17	Upgrade Mobile Communication Systems Vertiefung Mobile Nachrichtensysteme		4/2/0 PL	German/ English	**7**
ET-12 10 18	Digital Signal Processing Systems Digitale Signalverarbeitungssysteme		3/1/2 2 PL	German	**7**
NES-12 10 08	Introduction to Optical Non-classical Computing: Concepts and Devices		4/2/0 2 PL	English	**7**

Overview of the
Main studies modules 5th-10th semester
In the specialization area: **Microelectronics**

Module number, with link to description	**Module name** English German	**6th semes-ter summer semester** L/T/P	**7th semes-ter winter semester** L/T/P	**Language of instruction**	**ECTS Credits**
ET-12 08 26	Characterization and Modeling of Nanoelectronic Devices Modellierung und Charakterisierung nanoelektronischer Bauelemente	2/1/0 PL	2/0/1 PL	German	**7**
ET-12 12 02	Design of Microelectromechanical Systems Entwurf mikroelektromechanischer Systeme	4/2/0 2 PL		German	**7**
ET-12 11 01	Solid-State and Nano Electronics Festkörper- und Nanoelektronik		4/2/0 PL	German	**7**
ET-12 12 03	Applied Thin-Film and Solar Technology Angewandte Dünnschicht- und Solartechnik	6/0/0 PL		German	**7**
ET-12 05 09	Electronic Design Automation Entwurfsautomatisierung		2/4/0 2 PL	German	**7**
ET-12 06 07	Hybrid Integration Hybridintegration		4/0/2 3 d excur-sion 2 PL	German	**7**
ET-12 08 19	VLSI Processor Design VLSI-Prozessorentwurf		2/2/2 2 PL	English	**7**
ET-12 11 04	Sensors and Sensor Systems Sensoren und Sensorsysteme		4/1/1 2 PL	German	**7**
ET-12 12 04	Memory Technology	2/1/0	2/1/0 PL	English	**7**
ET- 12 11 05	Plasma Technology Plasmatechnik		4/2/0 PL	German	**7**

Overview of the
Main studies modules 5th-10th semester
In the specialization area: **Computer Science**

Module number, with link to description	**Module name** English German	**7th semester winter semester** L/T/P	**8th semester summer semester** L/T/P	**Language of instruction**	**ECTS Credits**
Applied Computer Science					
INF-BAS1	Introduction to Applied Computer Science Basismodul Angewandte Informatik	4/4/0 PL		German	**12**
INF-VERT1	Advanced Applied Computer Science Vertiefungsmodul Angewandte Informatik	PL		German	**15**
Artificial Intelligence					
INF-BAS2	Artificial Intelligence Basismodul Künstliche Intelligenz	PL		German	**12**
INF-VERT2	Advanced Artificial Intelligence Vertiefungsmodul Künstliche Intelligenz	PL		German	**15**
Software and Web-Engineering					
INF- BAS3	Introduction to Software and Web Engineering Basismodul Software- und Web-Engineering	PL		German	**12**
INF- VERT3	Advanced Software and Web Engineering Vertiefungsmodul Software- und Web-Engineering	PL		German	**15**
System Architecture					
INF- BAS4	Introduction to System Architecture Basismodul Systemarchitektur	PL		German	**12**
INF- VERT4	Advanced System Architecture Vertiefungsmodul Systemarchitektur	PL		German	**15**
Technical Computer Science					
INF- BAS5	Introduction to Computer Engineering Basismodul Technische Informatik	PL		German	**12**
INF- VERT5	Advanced Computer Engineering Vertiefungsmodul Technische Informatik	PL		German	**15**

Module descriptions
Basic studies modules 1st-4th semester

Module number	Module name	Lecturer in charge
ET-01 04 01	Introduction to Analysis and Algebra	Prof. Dr. rer. nat. habil. Z. Sasvári
Contents and objectives	Contents of the module are set theory, real and complex numbers, sequences of numbers and series, analysis of real functions of a variable, linear spaces and pictures, matrices and determinants, systems of linear equations, eigenvalues and eigenvectors. Outcomes: The students have basic mathematical knowledge and knowledge of algebra. They are capable to calculate with (complex) numbers and to apply functions, sequences and series, vectors (Vector space), determinants and matrizes.	
Modes of teaching and learning	6 hours per week lectures, 4 hours per week tutorials, and self-study	
Prerequisites	Knowledge of mathematics on “Abitur” level.	
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 180 minutes.	
ECTS credit points and grades	11 ECTS credit points The module grade is the grade of the exam.	
Frequency	Annually, in the winter semester	
Workload	330 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-01 04 02	Calculus for Functions with Several Variables	Prof. Dr. rer. nat. habil. Z. Sasvári
Contents and objectives	Contents of the module is the analysis of real functions of several variables, vector analysis, function series (power and Fourier series), differential equations. Outcomes: The students have knowledge of the differentiation and integration of functions with one and more variables, for the analytical solution of differential equations and differential equation systems and for the vector analysis.	
Modes of teaching and learning	4 hours per week lectures, 4 hours per week tutorials, and self-study	
Prerequisites	Competencies acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra.	
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 150 minutes.	
ECTS credit points and grades	9 ECTS credit points The module grade is the grade of the exam.	
Frequency	Annually, in the summer semester	
Workload	270 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
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 ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables.	
Requirements for the award of ECTS credit points	The credit points are earned ifthe module assessment is passed. The module assessment consists of a written exam of 120 minutes.	
ECTS credit points and grades	4 ECTS credit points cab be earned. The module grade is the grade of the exam.	
Frequency	Annually, in the winter semester	
Workload	120 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
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 ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory.	
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	4 ECTS credit points can be earned. 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
ET-01 04 05	Algebra	Director of the Institute of Algebra
Contents and objectives	The module covers graphs, orders and lattices, modular arithmetic, semigroups and groups, arithmetic in polynomial rings and finite bodies including applications, etc. After completing the module, students will have knowledge of basic algebraic structures that are important for their course of study. The students know the basic concepts of the mentioned theoretical areas and can handle them safely - in the sense of the mathematical mode of operation. They are able to formulate and prove facts of the mentioned areas thematically correct. They are able to put these theoretical elements into a meaningful context with applied questions and to solve tasks.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Knowledge in mathematics on highschool education level	
Requirements for the award of ECTS credit points	This module is a compulsory module of the basic studies in the diploma course of studies in information systems engineering. It is a prerequisite for the majority of the modules of the basic and main studies of the diploma study course Information Systems Engineering.	
ECTS credit points and grades	The credit points are earned if the module assessment is passed. The module assessment consists of a written exam of 90 minutes.	
Frequency	6 ECTS credit points can be earned. The module grade is the grade of the written exam.	
Workload	Annually, starting in the winter semester	
Duration	180 hours	

Module number	Module name	Lecturer in charge
INF-D-210	Algorithms and data structures	Prof. Dr. Heiko Vogler
Contents and objectives	Students will have knowledge of the basics of imperative programming (syntax diagrams, EBNF, functions, modules, data structures) and can use this knowledge to formulate algorithms for classical problems (sorting and search procedures, algorithms on trees and graphs). The students will know different classes of algorithms (di-vide-and-conquer, dynamic programming, iteration versus recursion, backtracking). As a first step towards complexity analysis, they can also analyze algorithms with respect to their runtime behavior.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Knowledge in mathematics on highschool education level	
Requirements for the award of ECTS credit points	The credit points are acquired if the module assessment is passed. The module assessment consists of written exam of 90 minutes.	
ECTS credit points and grades	5 ECTS credit points can be earned. The module grade is the grade of the written exam.	
Frequency	Annually, starting in the winter semester	
Workload	150 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
INF-B-230	Introduction project RoboLab	Prof. Dr. Christof Fetzer
Contents and objectives	After completing the module, students are able to solve practical tasks in computer science. They know the basics of team and project work as well as lecture and presentation techniques. The students are able to solve practical tasks of robot programming in a team and to present them afterwards.	
Modes of teaching and learning	4 hours per week practical lab course, and self-study	
Prerequisites	knowledge in mathematics, computer science and physics on highschool education level	
Requirements for the award of ECTS credit points	The credit points are acquired if the module assessment is passed. The module assessment consists of a project work of 5 weeks.	
ECTS credit points and grades	4 ECTS credit points The module grade is the grade of the project work.	
Frequency	annually, starting in the winter semester	
Workload	120 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
INF-B-240	Programming	Prof. Dr. Heiko Vogler
Contents and objectives	Students will have knowledge of functional programming and can apply this knowledge in practice. Students will have the skills to use and develop formal tools (basics of calculation, translation of program constructors, program transformations, verification of program properties).	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Basic knowledge of the imperative programming paradigm and the EBNF concept as well as competences acquired in modules such as INF-D-210 Algorithms and data structures, 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 90 minutes.	
ECTS credit points and grades	6 ECTS credit points The module grade is the grade of the written exam.	
Frequency	annually, starting in the summer semester	
Workload	180 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
INF-B-310	Software Technology	Prof. Dr. Uwe Aßmann
Contents and objectives	The students master the methods for the development of software systems. This enables students to apply a systematic engineering approach using the concepts of object orientation, in particular to master the use of the Unified Modelling Language (UML) in analysis, design and implementation. For the practical implementation of the systems the students master the specific use of the programming language Java, with special emphasis on the use of class libraries and design patterns. Basic information on project management and software quality assurance round off the contents	
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 INF-D-210 Algorithms and data structures, INF-B-230 Introduction project RoboLab, or equivalent. In particular, competences in the programming of class structures and procedures 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 written examination of 120 minutes.	
ECTS credit points and grades	6 ECTS credit points can be earned. The module grade is the grade of the written exam.	
Frequency	annually, starting in the summer semester	
Workload	180 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
INF-B-320	Software Technology project	Prof. Dr. Uwe Aßmann
Contents and objectives	The students will obtain practical engineering knowledge in the implementation of collaborative software projects. The students will be able to analyse the customer's requirements by working in close cooperation with him, and to collaboratively develop, design, implement and test a software system, and have them approved by the customer.	
Modes of teaching and learning	4 hours per week project, and self-study	
Prerequisites	Competences acquired in modules such as INF-B-310 Software Technology, 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 project work of 15 weeks.	
ECTS credit points and grades	6 ECTS credit points can be earned. The module will be graded as "passed" or "failed".	
Frequency	annually, in the winter semester	
Workload	180 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
INF-B-330	Computer Architecture	Prof. Dr. Rainer G. Spallek
Contents and objectives	The students will have a balanced theoretical and methodological understanding of the structure and organization of computers and their basic components. This especially refers to the basic understanding of complex computer systems, the use of parallelism and performance evaluation. Starting from the necessary basics of computer technology, the students will learn about the structure and function of the individual components of a computer structure, their organization and interaction. These are acquired by way of examples, starting with the implementation of switching networks and switching mechanisms at gate level, the representation, coding and processing of information, the instruction set as a link to the software and the components of a computer such as control unit, arithmetic unit, register and memory. The various types of parallelism, networking and evaluation of complex computer systems are understood.	
Modes of teaching and learning	4 hours per week lectures, 4 hours per week tutorials, and self-study	
Prerequisites	Competences in the field of Boolean algebra and Boolean functions	
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 examination of 240 minutes.	
ECTS credit points and grades	10 ECTS credit points The module grade is the grade of the written exam.	
Frequency	annually, starting in the winter semester	
Workload	300 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
INF-D-425	Hardware Laboratory	Prof. Dr. Diana Göhringer diana.goehringer@tu-dresden.de
Objectives	The students will have basic knowledge of the structure and functioning of information processing systems as well as the realization of simple analogue and digital circuits.	
Contents	The content of the module focuses on oscilloscopes, operational amplifiers, combinational circuits and flip-flops, sequential and machine-controlled circuits and von Neumann architecture.	
Modes of teaching and learning	3 hours per week practical lab course	
Prerequisites	Competences acquired in modules such as ET-12 08 11 Microelectronic Technologies and Devices, or equivalent, as well as confident knowledge in Boolean functions.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment consists of ungraded lab protocols.	
ECTS credit points and grades	3 ECTS credit points can be earned. The module is graded as "passed" or "failed". It is graded as "passed" if 80% of the lab protocols are passed.	
Frequency	annually, in the summer semester	
Workload	90 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 08 01	Fundamentals of Electrical Engineering	Prof. Dr. phil. nat. habil. Ronald Tetzlaff
Contents and objectives	Content: The calculation of direct current (DC) electrical networks Objectives: Having successfully completed this module, the students will have basic knowledge of electrical engineering and electronics and master methods for solving electrical engineering problems as a basis for further modules. The focus is on resistive circuits. Students are able to describe linear and nonlinear two poles and to consid-er the temperature dependence of their parameters, to analyze systemati-cally electrical DC circuits and to apply simplified analysis methods (two pole theory, superposition theorem). They are able to calculate the power dissipation in circuits as well as to analyze and determine their thermal behaviour.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Basic knowledge in mathematics and physics on highschool education level	
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	6 ECTS credit points The module grade is the grade of the written exam.	
Frequency	annually, in the winter semester	
Workload	180 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 08 02	Electric and Magnetic Fields	Prof. Dr. phil. nat. habil. Ronald Tetzlaff
Contents and objectives	The module content focuses on: fundamentals of electric and magnetic fields. Outcomes: After completing this module, students understand basic concepts, know physical quantities, and apply methods for calculating basic electric and magnetic fields. They are able to calculate the stored field energy, force effects, and induction phenomena of magnetic fields. Basic principles and the elementary electronic components resistor, capacitor, inductor, and transformer are known.	
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 ET-12 08 01 Fundamentals 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.	
ECTS credit points and grades	6 ECTS credit points can be earned. The module grade is the grade of the written exam.	
Frequency	annually, in the summer semester	
Workload	180 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
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 ET-12 08 01 Fundamentals of Electrical Engineering, or equivalent. The prerequisite for participation in the lab course is to pass the module exam of the module ET-12 08 01 Fundamentals 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
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 tutorials, and self-study	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-12 08 01 Fundamentals of Electrical Engineering, ET-12 08 11 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 can be earned. The module grade is the grade of the written exam.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 09 10	System Theorie and Automation Engineering	Prof. Dr.-Ing. habil. E. Jorswieck
Contents and objectives	Content: The module deals with 1. the fundamentals of systems theory with focus on digital systems, analogue time-continuous systems, analogue time-discrete systems and selected applications. 2. the fundamentals of automation engineering with 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 Objectives: Having successfully completed the module, the students 1. 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). 2. 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.	
Modes of teaching and learning	6 hours per week lectures, 4 hours per week tutorials, and self-study	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-12 08 01 Fundamentals 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 consists of two written exams of 120 minutes each (PL1 + PL2).	

ECTS credit points and grades	10 ECTS credit points can be earned. The module grade is the weighted mean of the two exams according to: M = (7 PL1 + 3 PL2) / 10.
Frequency	Annually, beginning in the winter semester
Workload	300 hours
Duration	2 semesters

Module number	Module name	Lecturer in charge
ET-12 08 11	Microelectronic Technologies and Devices	Prof. Dr.-Ing. habil. M. Schröter
Contents and objectives	The module includes - the physical fundamentals of electronic devices - the physical-technical fundamentals for their production by means of microtechnologies Objectives: The students are capable of: - understanding the fundamental functioning and electrical features of the most important semiconductor electronic devices on basis of a simplified description of the physical potential ratio and transport mechanisms in semiconductors - discussing the most important characteristic lines - constructing physical modell descriptions (including equivalent circuit diagrams) of semiconductor electronic devices for their application - working with fundamental principles for the production and miniaturisation of devices and circuits - understanding the modes of functioning of the individual technologies as well as their coaction resulting in simple process flows	
Modes of teaching and learning	5 hours per week lectures, 1 hour per week tutorial, and self-study.	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-12 08 01 Fundamentals of Electrical Engineering, Basics of Science, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. This assessment is a written exam of 210 minutes.	
ECTS credit points and grades	6 ECTS credits The module grade is the grade of the exam.	
Frequency	annually, in the winter semester	
Workload	180 hours	
Duration	1 Semester	

Module number	Module name	Lecturer in charge
ET-12 08 33	Digital Circuit Design	Prof. Dr.-Ing. habil. Ch. G. Mayr
Contents	The content of the module focuses on the functionalities and basic design principles of digital circuits. Based on knowledge of component models of active semiconductors, the systematic design and analysis of digital and mixed-signal basic circuits is taught. In addition, the module refers to architecture and system concepts of complex digital systems. The module content is based on innovative industrial concepts and questions in the field of VLSI circuit technology and is constantly being updated. Further, the module focuses on special circuit features in nanoscale CMOS technologies, methods to reduce power loss (low-power circuitry), measures to increase processing speed in high-speed circuits and interfaces, and the consideration of statistical influences of manufacturing technologies.	
Objectives	-Analysis, dimensioning and optimization of digital combinatorial and sequential basic elements based on current semiconductor technologies (CMOS, BiCMOS, etc.) -Design of complex logic functions in the form of arithmetic-logic circuits (e.g. ALUs, shifters, multipliers), state machines (finite state machines), flip-flops and oscillator circuits -Digital architecture and system concepts such as register transfer logic, memory architectures (DRAM, SRAM, EPROM) and mixed-signal circuits (ADC, DAC, interfaces -Design methodology for complex digital and mixed-signal systems (behavioural description, optimization, validation)	
Modes of teaching and learning	2 hours per week lectures, 1 hour per week tutorial, and self-study.	
Prerequisites	Competences acquired in modules such as ET-12 08 01 Fundamentals of Electrical Engineering, Electronic components, System Theorie and Mathematics.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. This assessment is a written exam of 120 minutes.	
ECTS credit points and grades	3 ECTS credits can be earned. The module grade is the grade of the exam.	
Frequency	annually, in the winter semester	
Workload	90 hours	
Duration	1 Semester	

Module number	Module name	Lecturer in charge
INF-B-275	Theory and Applications of Formal Systems	Prof. Dr. Franz Baader
Contents and objectives	Students are enabled to understand formal systems, to develop such systems in different forms of description and to use them in the context of compiler construction for the analysis of programs and code generation. Contents of the module are the theory of formal systems with the areas of formal languages, automata theory and logic as well as compiler construction as a possible application area of formal systems with lexical, syntactic and semantic analysis, automatic parser generation and code generation.	
Modes of teaching and learning	6 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Basic knowledge of mathematics (discrete structures, analysis, linear algebra) as well as of algorithms and data structures and programming is required.	
Usability	This module is a compulsory module in the diploma course of studies in information systems engineering.	
Requirements for the award of ECTS credit points	The credit points are acquired if the module examination is passed. The module examination consists of two written esxams of 90 minutes (PL1 + PL2) each.	
ECTS credit points and grades	10 ECTS credit points The module grade is calculated from the weighted arithmetic mean of the grades according to: ¾ PL1, ¼ PL2.	
Frequency	Annually, starting in the winter semester	
Workload	300 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
INF-B-370	Databases/ Computer Networks	Prof. Dr. Alexander Schill
Contents and objectives	Students have knowledge of database theory and are able to solve application problems in practice. The main focus is on the entity relationship model, the relational data model including the design theory of relational databases and the XML data model as well as on the implementation of database systems, error handling and query processing in database systems. Students are able to apply information technology contexts to concrete example networks, develop transmission methods and associated protocols step-by-step and protect them against errors and attacks, analyse and evaluate network technologies and understand Internet protocol mechanisms and distributed system architectures.	
Modes of teaching and learning	4 hours per week lectures, 4 hours per week tutorials, and self-study	
Prerequisites	Prerequisites are a knowledge of mathematics at high school graduation level, the ability to think methodically and the competences to be acquired in the modules ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, INF-D-210 Algorithms and data structures, INF-B-230 Introduction project RoboLab, INF-B-240 Programming, INF-B-310 Software Technology, with regard to the basic concepts, basic algorithms and architectural concepts of computer science.	
Requirements for the award of ECTS credit points	The credit points are acquired if the module examination is passed. The module examination consists of two 90-minute written examinations.	
ECTS credit points and grades	10 ECTS credit points The module grade is calculated from the average of the grades of the individual examination performances.	
Frequency	Annually, starting in the summer semester	
Workload	300 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
INF-B-380	Operating Systems and Security	Prof. Dr. Hermann Härtig
Contents and objectives	Students have knowledge of database theory and are able to solve application problems in practice. The main focus is on the entity relationship model, the relational data model including the design theory of relational databases and the XML data model as well as on the implementation of database systems, error handling and query processing in database systems. Students are able to apply information technology contexts to concrete example networks, develop transmission methods and associated protocols step-by-step and protect them against errors and attacks, analyse and evaluate network technologies and understand Internet protocol mechanisms and distributed system architectures.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Competences in computer architecture and organization, imperative programming (e.g. C or Java), stochastics (random variables and distribution) and a basic understanding of program verification are expected, as they are described in the modules ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, INF-D-210 Algorithms and data structures, INF-B-230 Introduction project RoboLab, INF-B-240 Programming, INF-B-310 Software Technology, and INF-B-330 Computer Architecture.	
Requirements for the award of ECTS credit points	The credit points are acquired if the module examination is passed. The module examination consists a 90-minute written examination.	
ECTS credit points and grades	7 ECTS credit points The module grade corresponds to the grade of the examination paper.	
Frequency	Annually, starting in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
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 ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, Systems Theory, 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 descriptions
Main studies modules 5th-10th semester

Module number	Module name	Lecturer in charge
ET-12 01 10	Industrial Automation Engineering 1	PD Dr.-Ing. Annerose Braune
Contents and objectives	Content: Automation technology solutions for locally distributed automation systems using current information technologies such as the Internet, XML and model-driven technologies in automation technology Objectives: The students 1. are capable of working with basic concepts, protocols and services of the Internet technologies 2. have basic experience and skills in dealing with current technologies that are relevant for automation 3. are capable of evaluating basic risks and opportunities of the application of modern information technologies 4. are capable of solving a managebale application with the learned methods as a small project.	
Modes of teaching and learning	3 hours per week lectures, 1 hour per week tutorial, 2 hours per week project, and self-study	
Requirements for the award of credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of a written exam of 120 minutes (PL1) and a project of 15 weeks (PL2).	
ECTS credit points and grades	7 ECTS credit points The module grade (M) is determined by the weighted average of PL1 and PL2: M = (4PL1 + 3PL2)/7.	
Frequency	annually, beginning in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 01 11	Industrial Automation Engineering 2	Prof. Dr. techn. Klaus Janschek
Content and objectives	Content: Automation technolgy concepts and solutions for selected applications, such as position control for space vehicles, embedded systems, or industrial automation means. Objectives: The students 1. are able to design basic concepts, model descriptions and approaches of the respective application domain 2. master fundamental solution methods 3. are capable of dealing with examples of automation devices.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorial, 1 hour per week project, and self-study	
Prerequisites	Competences in the field of Automation Engineering and Measurement.	
Requirements for the award of credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of a written exam of 120 minutes (PL1) and a project of 15 hours (PL2).	
ECTS credit points and grades	7 ECTS credit points The module grade M is determined by the weighted average: 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
ET-12 01 12	Robotics	Prof. Dr. techn. Klaus Janschek
Content and objectives	Content: **1. Control of serial manipulators** – Kinematic fundamentals – Trajectories – Robot dynamics – Position control – Force control **2. Control of mobile robots** – Kinematic fundamentals – Navigation (localization) – Path planning Objectives: The students are capable of 1. applying controlled industrial robot systems. They master the theoretical and computational handling of behavior models and algorithms for the controlling of industrial robot systems (manipulators, serial kinematics). 2. working with behavioral models for the navigation (position, orientation) and path planning of autonomous mobile robot platforms. They master the basic methodological and algorithmic approaches 3. solving a manageable design task with the learned methods as a small project.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, 1 hour per week project, and self-study	
Prerequisites	Competences in the fields of Control of Continuous-Time Processes and Modelling and Simulation.	
Requirements for the award of credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of two written exams of 120 minutes each and a project of 20 hours.	
ECTS credit points and grades	7 ECTS credit points The module grade is the weighted mean of the grades for the elements of assessment: The grades for the written exams contribute by 3/7 each and the grade for the project by 1/7.	
Frequency	Annually, beginning in the summer semester.	
Workload	210 hours	

Duration	2 semesters

Module number	Module name	Lecturer in charge
ET-12 01 13	Systems Design	Prof. Dr. techn. Klaus Janschek
Content and objectives	Content: **1. System design of mechatronic systems** - Multi-body dynamics - Mechatronic converter principles - Stochastic behavior analysis - System budgets **2. System design of complex automation systems** - Definition of requirements - Function-oriented behavior modeling - Object-oriented behavioral modeling - Fundamentals of project management Objectives: The students are capable of 1. applying methods and tools of physically based behavior modeling and analysis (mechatronic systems). They are able to conduct a sound quantitative evaluation of design and optimization. 2. working with concepts, methods and tools of abstract behavior modeling and analysis (complex automation systems). They are able to conduct a sound quantitative evaluation of design and optimization.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study	
Prerequisites	Competences in the field of Control of Continuous-Time Processes and Modelling and Simulation.	
Requirements for the award of credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of two written exams of 120 minutes each.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of both elements of assessment.	
Frequency	Annually, in the winter semester.	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 01 20	Human Machine Systems Technology	Prof. Dr.-Ing. habil. Leon Urbas
Content and objectives	Content: Principles and methods of the human-machine-system to take into account the human factor in the analysis, evaluation and design of complex, interactive technical systems Objectives: The students 1. master fundamental methods of the human-machine systems technology for the description, analysis, evaluation and design of dynamic interactive systems. 2. are capable of working systematically on domain-specific issues of human-machine interaction.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorial, 2 hours per week practical lab course and self-study	
Prerequisites	Competences in the fields of Automation Engineering and Measurement, and Process Control.	
Requirements for the award of credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of a written exam of 120 minutes and a project of 30 hours.	
ECTS credit points and grades	7 ECTS credit points The module grade is determined by the weighted average of both elements of assessment.	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 01 21	Project Planning for Process Automation Systems	Prof. Dr.-Ing. habil. Leon Urbas
Content and objectives	Content: Methods for Computer Assisted Engineering in Process Automation (CEA-PA) with the following focus: 1. computer-aided integrated and life-cycle-wide project planning of process automation systems with e.g. requirements analysis, basic, detail and order engineering, implementation and commissioning, information modeling for integrated engineering systems 2. implementation in automation projects Objectives: The students 1. know the methods and means for computer-aided project planning of complex automation systems from process requirements and 2. can implement these in specific domains and application areas or deepen these by means of further computer-based methods.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorial, 2 hours per week project, and self-study. The language of instruction is at least partly English.	
Requirements for the award of credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of a written exam of 120 minutes in English language and a project of 30 hours. The written exam can be answered in English or German, depending on the student's choice.	
ECTS credit points and grades	7 ECTS credit points The module grade is determined by the arithmetic mean of both elements of assessment: M = (PL1 + PL2) / 2	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration of the module	1 semester	

Module number	Module name	Lecturer in charge
ET-12 01 22	Process Management Systems	Prof. Dr.-Ing. habil. Leon Urbas
Content and objectives	Content: Knowledge-based methods and algorithms for automated process evaluation, diagnosis and management Objectives: The students are capable of 1. designing, implementing and operating complex knowledge-based process-oriented (partially) automated information processing systems, 2. combining and applying these methods with system theoretical and automation engineering approaches in order to implement complex automation systems.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorial, 2 hours per week practical lab course, and self-study	
Prerequisites	Competences in the field of Process Control and Microcomputer Technology.	
Requirements for the award of credit points	The credit points are awarded if the module assessment is passed. The module assessment consists of a written exam of 90 minutes each, an oral exam of 90 minutes, and a project of 30 hours.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of the module assessments.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration of the module	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 05 09	Electronic Design Automation	Prof. Dr.-Ing. habil. J. Lienig
Contents and objectives	This module covers - Relevance of electronic design automation (EDA) - Design styles, design steps, layout design, geometrical fundamentals, etc. - Floorplanning - Partitioning and placement algorithms - Routing algorithms - Methods for compaction and verification - Trends in EDA Intended learning outcomes: Students completing this module have obtained knowledge of algorithms which are used in modern design tools for physical design automation (going from netlist to the final layout). They are thus capable of writing design modules on their own or adapting commercial design tools for specific tasks.	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, 2 hours per week seminars, and self-study	
Prerequisites	Students should have knowledge of the basics of electrical engineering.	
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 examination of 30 minutes and tutorial assignments. Both elements of assessment must be passed.	
ECTS credit points and grades	7 ECTS credit points The module grade is determined by the weighted average of both elements of assessment: M = (3PL1 + 2PL2) / 5	
Frequency	annually, during winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 06 07	Hybrid Integration	Prof. Dr.-Ing. habil. Dr. h.c. Karlheinz Bock
Contents and objectives	This module includes two parts **1. Hybrid technique** (***Hybridtechnik***) - Technologies for the Hybrid technique, - thin film- and thick film technologies, - substrates and pastes, - thermal processes, - single layer and multilayer techniques, - design rules, hybridisation, components, housing - printing, sintering, laser application and trimming - packaging techniques, - functional test, and **2. Micro und nano integration** (***Mikro- und Nano-Integration***) - Micro and nano integration of electronic components, - nano scaling und nano materials, - processes and tools for the nano structuring, - photonic und nano systems, 3D integration The module provides skills in the fields of thin film and thick film technologies, hybrid integration and packaging of such components. The knowledge of micro and nano integration qualifies the students for the solving of innovative tasks in the electronic packaging technology. The students become able to estimate and choose such technologies.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week practical lab courses, up to 3 one-day excursions, and self-study	
Prerequisites	Competences in the field of electronic packaging technologies as acquired in the module ET-12 08 11 Microelectronic Technologies and Devices.	
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 practical lab course. Both assessments have to be passed.	
ECTS credit points and grades	7 ECTS credit points The module grade is the weighted average for the written exam (2/3) and the lab course (1/3).	
Frequency	annually, in the winter semester	
Workload	210 hours	

Duration	1 semester

Module number	Module name	Lecturer in charge
ET-12 08 07	Introduction to the Theory of Nonlinear Systems	Prof. Dr. phil. nat. habil. R. Tetzlaff
Contents	The module contents: 1. phenomena and analysis of nonlinear systems (including chaotic systems) 2. specialization in the theory and application of "Cellular Neural Networks". Outcomes: After completing the module the students know the stability analysis by linearization and by applying Lyapunov functions, as well as the Volterra analysis of nonlinear transmission systems. Students know the properties of Cellular Neural Networks (CNN) and are able to realize binary information processing by means of these networks. The participants have an understanding of the structure CNN-based computers and are able to simulate the behavior of such networks numerically.	
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 ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-12 08 01 Fundamentals of Electrical Engineering, ET-12 08 02 Electric and Magnetic Fields and Systems Theory.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessement is passed. If the number of registered students exceeds 10, the assessment consists of two written exams of 90 minutes each. With up to 10 registered students, the written exams are replaced by oral exams as individual exams of 30 minutes each.	
ECTS credit points and grades	7 ECTS credit points The module grade is determined by the arithmetic mean of the grades of the two exams.	
Frequency	annually, starting in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 08 08	Circuit Simulation and System Identification	Prof. Dr. phil. nat. habil. R. Tetzlaff
Contents and objectives	The module contents: the mathematical basics of system identification and its practical application, basic system properties, important modeling approaches, methods for parameter identification and essential aspects of signal selection and data conditioning as well as adaptation of model parameters with appropriate algorithms. Outcomes: The students can select suitable model approaches based on theoretical considerations (linear/nonlinear, time/frequency domain). They are aware of simplifications made and consider specific boundary conditions for the applied methods. Students are able to define and analyze the set of data available for the identification and to evaluate it in terms of suitability. The students master the application of common methods for system identification and are able to evaluate the result.	
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 ET-12 08 01 Fundamentals of Electrical Engineering, ET-12 08 31 Electronic Circuits, Systems Theory, ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessement is passed. The assessment consists of two written exams of 120 minutes.	
ECTS credit points and grades	7 credit points The module grade is the arithmetic mean of the two exams.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 08 26	Characterization and Modeling of Nanoelectronic Devices	Prof. Dr.-Ing. habil. M. Schröter
Contents and objectives	The module contains the course ***Characterization and modeling of electronic devices*** along with a student lab. The module includes: - Current topics and trends in the field of experimental characterization and modeling of micro- and nanoelectronic components, including model parameter determination. After completing this module, students are capable of - understanding the basic operation of selected advanced transistors, their most important practical characteristics, and associated compact models for high-frequency circuit design; - applying advanced methodologies for model parameter extraction under industrial conditions; - understanding industrially relevant measurement methods for device characterization and analyzing/interpreting test results.	
Modes of teaching and learning	4 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 ET-12 08 11 Microelectronic Technologies and Devices, Physics of Selected 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 90 minutes and an assignment of 20 hours.	
ECTS credit points and grades	7 ECTS credit points The grade is the weighted mean of the grades of the assessments.	
Frequency	Annually, in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 12 02	Design of Microelectromechanical Systems	Prof. Dr.-Ing. habil. U. Marschner
Contents and objectives	Contents of the module are 1. Design of microsystems with modelling and simulation of technological procedures and processes (electrical components, sensors and actuators as well as complete systems) 2. Electromechanical networks with electrical, mechanical, magnetic, fluidic (acoustic) and coupled subsystems including their interactions (common circuit diagram and their behaviour simulation with existing circuit simulation software, such as SPICE), 3. Combination of network simulation with the method of finite element modelling (complete systems consisting of electrical and non-electrical components) The students have knowledge - he basic model descriptions of technological processes, - for effective design and clear analysis of the dynamic behaviour of electromechanical and electromagnetic systems, - on the function and modelling of reversible converters in sensors and actuators, - the functionality and possible applications of finite element methods and finite difference methods, - for the overall system description using HDL languages.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, 1 hour per week Paperwork and self-study.	
Prerequisites	The competences to be acquired in the modules Materials and Technical Mechanics and Scientific Fundamentals are required.	
Usability	The module is a compulsory elective module in the field of microelectronics in the diploma course in electrical engineering, in the diploma course in information systems engineering and in the master course in electrical engineering.	
Requirements for the award of ECTS credit points	The credit points are acquired if the module examination is passed. The module examination consists of a written paper PL1 of 150 minutes duration and a paper PL2.	
ECTS credit points and grades	7 ECTS credit points The module grade M results from the weighted average of the grade of the examination performance: M = (3 PL1 + PL2) / 4.	
Frequency	Annually, starting in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET- 12 08 16	Radio Frequency Integrated Circuits	Prof. Dr. sc. techn. habil. F. Ellinger
Contents and objectives	The content of the module focuses on: - high frequency integrated circuits for high speed wireless communications such as low noise amplifiers, power amplifiers, mixers, oscillators on basis of active and passive devices, as well as complete radio frontends and architectures - advantages and challenges of aggressively scaled CMOS and BiCMOS, Moore than Moore (e.g. FinFET, SOI, strained silicon) and Beyond more Moore (silicon nano wire, CNT and organic) technologies are discussed from circuit design perspective. After completion of the module, the students obtain competences regarding - methods for the design of analog high frequency integrated circuits. They know the basic circuits and architectures of the systems. - analysis and optimisation of these circuits, - complete design cycle for high frequency integrated circuits using the Cadance CAD system and are therefore prepared in this field for the requirements in industry and academia, - technical English	
Modes of teaching and learning	3 hours per week lectures, 1 hour per week tutorial, 2 hours per week practical lab courses, and self-study. The lecture is given in English.	
Prerequisites	Students should have basic knowledge of circuit design on Bachelor level.	
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	7 ECTS credit points The module grade is the grade of the written exam.	
Frequency	annually, during the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET- 12 08 17	Integrated Circuits for Broad-band Optical Communications	Prof. Dr. sc. techn. habil. F. Ellinger
Contents and objectives	Integrated circuits for optical broadband communications, such as transimpedance amplifiers, detector circuits, laser drivers, multiplexers, frequency dividers, oscillators, phase locked loops, synthesizesr and data recovery circuits. Students learn the methods of the design of fast integrated circuits and systems for optical broadband communications. They are able to analyse and optimise these circuits. The students know the complete design cycle using the program CADENCE.	
Modes of teaching and learning	3 hours per week lectures, 1 hour per week tutorial, 2 hours per week practical lab courses, and self-study. The language of instruction is English.	
Prerequisites	Competences acquired in modules such as ET-12 08 31 Electronic Circuits (on Bachelor level).	
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	7 ECTS credit points 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
ET-12 08 18	Integrated Circuit Design	Prof. Dr.-Ing. habil. C. Mayr
Contents and objectives	The content of the module includes the basics and methods for development of application-specific digital integrated circuits (ASICs). This involves the transformation of a numeric algorithm into a data-dependency graph, the useage of scheduling and allocation procedures, optimizing regarding the consumption of resources (area, duration) as well as the implementation and functional verification (simulation) of the ASIC. After completing the module, the students are enabled to develop the data path (register transfer description) and the control unit (FSM) of a slected numerial algorithm using a data dependency graph. They know the implementation flow, which includes both the automated synthesis of complex blocks based on a hardware description language (eg. Verilog), as well as manually optimized digital data path elements.	
Modes of teaching and learning	2 hours per week lectures, 1 hour per week tutorial, 2 hours per week practical lab courses, and self-study	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, ET-01 04 04 Partial Differential Equations and Probability Theory, ET-12 08 01 Fundamentals of Electrical Engineering ET-12 08 11 Microelectronic Technologies and Devices ET-12 08 31 Electronic Cicuits.	
Requirements for the award of credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a project report of 40 hours.	
Credit points and grades	7 ECTS credit points The module grade is the grade of the project report.	
Frequency	annually, beginning in the winter semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 10 27	Signal processing and information theory	Prof. Dr.-Ing. E. Jorswieck
Contents and objectives	The content of the module focuses on the analysis of continuous-time and discrete-time signals in the time and frequency domain, the description and analysis of stochastic signals and processes, and the basics of information theory in the areas of source and channel coding. Students master the basic principles and practical application of signal processing methods in the time and frequency domain. They are familiar with the differences and relationships between the processing of continuous-time and discrete-time signals. They are familiar with the different forms of spectral analysis and are able to decide which form is to be used under which conditions. In particular, they have mastered computer-aided short-term spectral analysis and are familiar with its special features in application. They master the description methods of stochastic signals as realizations of stochastic processes. The students also know the basics of Shannon's information theory and essential information theoretical results (coding theorems). They are familiar with the essential statements and derivations of the maximum possible lossless compression of data (source coding) and the maximum speed of a reliable data transmission (channel coding). They are familiar with the information measures (entropy, transinformation, capacity, etc.) required for analytical considerations, as well as their properties and operational significance, and are able to calculate with these measures with confidence.	
Modes of teaching and learning	4 hours per week lectures, 3 hours per week tutorials, and self-study	
Prerequisites	Knowledge of probability theory and systems theory is required, which can be acquired in the modules ET-01 04 04 Partial Differential Equations and Probability Theory, ET-12 09 10 System Theorie and Automation Engineering, or equivalent.	
Usability	This module is a compulsory module in the diploma course of studies in Information Systems Engineering.	
Requirements for the award of ECTS credit points	The credit points are acquired if the module examination is passed. The module examination consists of two written exams PL1 and PL2 of 120 minutes each. Both examinations must be passed.	

ECTS credit points and grades	7 ECTS credit points can be earned. The module grade M results from the arithmetic mean of the grades of the examinations: M = (PL1 + PL2) / 2.
Frequency	Annually, starting in the winter semester
Workload	210 hours
Duration	2 semesters

Module number	Module name	Lecturer in charge
ET-12 08 19	VLSI Processor Design	Prof. Dr.-Ing. habil. C. Mayr
Contents and objectives	Content of the module: - Basics, concepts and methods for designing complex digital VLSI-systems - Architectures for highly integrated digital processing systems, with emphasis on user-specific signal processing systems - Methods for the efficient transfer of architectural concepts in the highly integrated implementation of a digital system. - Specification and abstract modelling of the system, conversion into a Register-Transfer-Level (RTL) description, automated circuit synthesis and physical implementation (place & route, layout synthesis), delivering the data for the manufacture of the chip. - Verification of the design on all levels of abstraction (behaviour, implementation) via simulation (functional verification) - Proof of the equivalence of transformation steps via formal verification, i.e. by checking compliance with design rules (signoff-verification) - Training in working together as a design team (division of tasks, definition of interfaces, schedule planning and time management) Objectives: After completion of this module, the students will be able to carry out a complete implementation and verification of a VLSI-System (e.g. a processor with a complexity comparable to an 8051) using industrial design software (Synopsys, Cadence).	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, 2 hours per week practical lab courses, and self-study	
Prerequisites	Competences acquired in modules such as ET-12 08 01 Fundamentals of Electrical Engineering, ET-01 04 03 Complex Function Theory, ET-01 04 04 Partial Differential Equations and Probability Theory, ET-12 08 31 Electronic Circuits, Systems Theory, or equivalent.	
Requirements for the award of credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a project report of 30 hours and an oral presentation of 20 minutes.	

Credit points and grades	7 ECTS credit points The module grade is the weighted average of the grade of the project report and the grade of the oral presentation: M = (2 PL1 + PL2) / 3.
Frequency	annually, in winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
ET-12 08 19	VLSI Processor Design	Prof. Dr.-Ing. habil. C. Mayr
Contents and objectives	Content of the module: - Basics, concepts and methods for designing complex digital VLSI-systems - Architectures for highly integrated digital processing systems, with emphasis on user-specific signal processing systems - Methods for the efficient transfer of architectural concepts in the highly integrated implementation of a digital system. - Specification and abstract modelling of the system, conversion into a Register-Transfer-Level (RTL) description, automated circuit synthesis and physical implementation (place & route, layout synthesis), delivering the data for the manufacture of the chip. - Verification of the design on all levels of abstraction (behaviour, implementation) via simulation (functional verification) - Proof of the equivalence of transformation steps via formal verification, i.e. by checking compliance with design rules (signoff-verification) - Training in working together as a design team (division of tasks, definition of interfaces, schedule planning and time management) Objectives: After completion of this module, the students will be able to carry out a complete implementation and verification of a VLSI-System (e.g. a processor with a complexity comparable to an 8051) using industrial design software (Synopsys, Cadence).	
Modes of teaching and learning	2 hours per week lectures, 2 hours per week tutorials, 2 hours per week practical lab courses, and self-study	
Prerequisites	Competences acquired in modules such as ET-12 08 01 Fundamentals of Electrical Engineering, ET-01 04 03 Complex Function Theory, ET-01 04 04 Partial Differential Equations and Probability Theory, ET-12 08 31 Electronic Circuits, Systems Theory, or equivalent.	
Requirements for the award of credit points	The credit points are earned if the module assessment is passed. The module assessment consists of a project report of 30 hours and an oral presentation of 20 minutes.	

Credit points and grades	7 ECTS credit points The module grade is the weighted average of the grade of the project report and the grade of the oral presentation: M = (2 PL1 + PL2) / 3.
Frequency	annually, in winter semester
Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
IST-W-22-DLMST	Digital Laser Measurement Technology	Prof. Dr.-Ing. habil. J. Czarske
Contents and objectives	The module deals with the basic principles, the theory of computer-aided optical measuring systems. It includes: - laser measurement technology - digital holography and image processing - project laser sensors Objectives: Students will be able to describe laser optical measuring systems and to digitally analyse measured values.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week tutorials, 2 hours per week project and self-study	
Prerequisites	Competences acquired in modules such as ET-12 09 10 System Theorie and Automation 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 30 minutes (PL1) and a project work (PL2) of 12 weeks.	
ECTS credit points and grades	7 ECTS credit points The module grade is the weighted average of both module assessments according to: M = (5 PL1 + 2 PL2) / 7.	
Frequency	annually, beginning in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 09 13	Applied Intelligent Signal Processing	Jun.-Prof. Dr.-Ing. P. Birkholz
Contents and objectives	The content of the module includes: - methods for recording and analyzing audio signals, image signals and biosignals - methods of classification and regression in the field of machine learning - the implementation of selected processes from 1) and 2) on an embedded system	
Modes of teaching and learning	4 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 Signal Theory.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment is a written exam of 150 minutes and an ungraded lab course.	
ECTS credit points and grades	7 ECTS credit points The module grade is the unweighted mean of the parts of the assessment.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 09 04	Speech Technology	Jun.-Prof. Dr.-Ing. P. Birkholz
Contents and objectives	The module content includes: The algorithms and methods required for the lingual human-machine interaction (speech recognition and speech synthesis). Learning outcomes: Successful students master the latest technologies being used in speech recognition and speech synthesis. They know the basic concepts of linguistics and the hierarchical semiotic system and the structures of natural language. They are able to define it by means of formal languages and grammars and employ this knowledge in the development of speech recognition systems. Furthermore, they know the structure of speech synthesis systems and the algorithms used in linguistic-phonetic and acoustic-phonetic implementations. They know how to adapt these systems to meet specific demands such as multilingual or multimodal interaction.	
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 Signal Theory, ET-12 09 03 Intelligent Audio Signal Processing, 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 150 minutes. The lab course has to be passed.	
ECTS credit points and grades	7 ECTS credit points 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
ET-12 09 08	Room Acoustics/ Virtual Reality	Prof. Dr.-Ing. habil. E. Altinsoy
Contents and objectives	This module provides the theoretical and practical foundation for room acoustics (first part) and interface design for virtual reality applications (second part). 1)The first part of the module (room acoustics) includes the theory of sound fields in enclosed spaces, geometrical acoustics, sound absorbers, electroacoustic systems in rooms and design of lecture halls, concert halls, opera houses, etc. 2) The aim of the second part of the module is to present the advanced concepts for generation of real-time interactive auditory, haptic, and visual virtual environments. Nowadays, such kinds of systems play a pronounced role in scientific and industrial research & development and, thus, become more and more important as tools for automotive industry (e.g. driving simulators, prototyping of engineering designs, restyling, ergonomics, etc.), telecommunication industry, architecture, and entertainment industry. Students learn audio recording and reproduction technologies (binaural techn., stereophony, surround sound, VBAP, ambisonics, wave field synthesis), implementation of room acoustical models, sound synthesis techniques, haptic and visual reproduction technologies. Furthermore, students will be exposed to the process of creating virtual environments, by developing some small VR applications (auditory/haptic/visual) as members of a small team.	
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 Systems Theory, Signal Theory, Acoustics, 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 an oral exam of 55 minutes as individual exam and a project work of 30 hours.	
ECTS credit points and grades	7 ECTS credits points The module grade is the arithmetic mean of the oral exam and the project work: M = (PL1 + PL2) / 2.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 09 09	Psychoacoustics / Sound Design	Prof. Dr.-Ing. habil. E. Altinsoy
Contents and objectives	This module gives an introduction to: 1.Psychoacoustics: Psychoacoustics is concerned with the relationships between the physical characteristics of sounds and their perceptual attributes. The aim of this module is to give students an understanding on the theory and practice of psychophysics, including the various aspects of psycho-acoustics, such as sensitivity, masking, loudness, sharpness, pitch, timbre and roughness. In this module various binaural models and the aspects of the binaural hearing will be introduced. 2. Sound design Each perceived sound in product use is a carrier of information. Each sound has a meaning to its listener, and as such each sound is perceived as a sign. The humming sound inside a car is mostly associated with, e.g., sportiness. This module outlines basic principles of sign theory and gives guidelines to how human perception of a product is affected by product sounds. Intended learning outcomes: Students learn to construct signals, which evoke – if they are heard – specific physical, affective or psychomotor reactions. They are qualified for the product development, e.g., in the automotive, hearing aid, household appliance or telecommunication industry and in medical engineering companies.	
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 Measurement and Sensor Techniques, Acoustics, 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 90 minutes and a project of 30 working hours.	
ECTS credit points and grades	7 ECTS credits The module grade results from the arithmetic mean of both elements of assessment.	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 10 05	Communication Networks, Advanced I	Prof. Dr.-Ing. Frank Fitzek
Contents and objectives	Content: • The planning process for communication networks with transport, service and cost modelling and principles for the dimensioning and routing in communication networks, including their implementation in algorithmic or heuristic optimization approaches • Integrated packet networks with selected basics of networking technologies and protocols for LAN, MAN and WAN Objectives: Having succeessfully completed this module, the students have a sound knowledge of planning, dimensioning and optimization of integrated communication networks. They understand the procedures and protocol structures that are used for efficient, flexible and reliable operation of these networks and have an overview of currently used technologies and their trends. The students are familiar with the basic technologies for integrated communication networks. They understand the system structures and processes and are able to evaluate and apply these. They master the most important networking technologies, their operating principles and protocols and are able to apply these to new problems.	
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 ET-12 10 24 Communications and Communication Networks, Basics, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. If the number of registered students exceeds 15, the assessment consists of two written exams of 120 minutes each. With up to 15 registered students, the assessment consists of an oral exam as individual exam of 30 minutes and a written exam of 120 minutes.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of the grades for both elements of assessment.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 10 19	Optimization in modern Communication Systems	Prof. Dr.-Ing. E. Jorswieck
Contents and objectives	Content: The foundations of optimization in communication systems and modern methods of signal processing for communication in radio systems Objectives: The students are familiar with optimization problems that occur in communication technology as well as with modern approaches and methods of information theory and signal processing. The students have the mathematical knowledge necessary for classifying these problems and master both analytical methods as well as numerical methods for the solution thereof. They are able to apply these to different scenarios and are thus able to develop optimal and efficient strategies for current problems in modern communication systems.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study. The language of instruction can be either German or English. At the beginning of the teaching period, the lecturer announces the language the module will be taught in.	
Prerequisites	Competences acquired in modules such as Information Theory, Systems Theory, 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 120 minutes each each.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of the grades for both elements of assessment.	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 10 20	Communication Networks, Advanced II	Prof. Dr.-Ing. Frank Fitzek
Contents and objectives	Content: • Tools for analyzing the performance of communication systems, in particular the analytical and simulative approach, and the exemplary realization by implementation • Future communication systems, their planning, analysis and structure • Approaches to project-based work, incl. work-structuring and presentation of the results (in writing and oral) in front of an expert public Objectives: Having successfully completed this module, the students have a thorough understanding of the modelling and performance analysis of communication networks and their protocols. They are able to chose and apply appropriate methods of investigation for various problems. The students have learned to look at their tasks in a professional manner, to structure their project in terms of work and time, and to present their results in a public-oriented manner.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study. The language of instruction is English.	
Prerequisites	Competences acquired in modules such as ET-12 10 24 Communications, ET-12 10 04 Communication Networks, Basic Module, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. If the number of registered students exceeds 15, the assessment consists of a written exam o 120 minutes and a project of 30 hours. With up to 15 registered students, the assessment consists of an oral exam as individual exam of 30 minutes and a project work of 30 hours.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of the grades for both elements of assessment.	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 10 09	Information Theory, Advanced I	Prof. Dr.-Ing. E. Jorswieck
Contents and objectives	This module comprises: Elements of the multi-user information theory, meaning capacity regions and attainable rate regions of multiple access channels, broadcast channels, relay channels, interference channels with coding theorems and converse Intended learning outcome: After completing this module, students are familiar with the elements of the network information theory and the basic results regarding capacity regions und attainable rate regions. Students further obtain information theoretical and mathematical tools to prove coding theorems. Amongst these coding theorems are superposition coding, Gelfand-Pinkser coding, dirty-paper coding, successive-interference-cancellation, Han-Kobayashi-coding, backward-decoding and many more. Furthermore, students will know the current status of technology – e.g. the capacity region of the multi-antenna broadcast channel – as well as unsolved issues regarding network information theory and its difficulties. They further apply their gained knowledge and the functional interpretation of system designs of future mobile communication systems, for cellular systems (multiple access and broadcast channel), relay and multi-hop systems as well as ad hoc networks to specific tasks. Moreover, they confidently deploy various performance metrics, are familiar with the stochastic description of wireless networks, and can evaluate average and outage-performances.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study. The language of instruction can be German or English, and is announced at the beginning of the semester by the lecturer.	
Prerequisites	Competences provided by modules such as Information Theory.	
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 120 minutes each.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of the two written exams.	
Frequency	annually, in the winter semester	

Workload	210 hours
Duration	1 semester

Module number	Module name	Lecturer in charge
ET-12 10 13	RF Systems	Prof. Dr.-Ing. D. Plettemeier
Contents and objectives	The module content: The operation and the physical basics of modern RF and wireless systems. Objectives: The students are familiar with ground- and satellite-based radio navigation and positioning systems. Communication satellite links can be described at system level. Basic understanding of satellite technology, antenna systems and phenomena of wave propagation (free space propagation, atmospheric absorption, plasma frequency, reflection and scattering, Doppler effect, etc.) are taught. The students are familiar with the different radar techniques (e.g. pulse-radar, pulse Doppler radar, FMCW radar and secondary radar, MTI principle, chirp) and with the system description and signal processing. They have obtained knowledge regarding the functionality and methods of the signal processing of radar imaging techniques (e.g. SAR principles).	
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 RF 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 is an individual oral exam of 45 minutes.	
ECTS credit points and grades	7 ECTS credit points The module grade is the grade of the oral exam.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 10 15	Basics Mobile Communications Systems	Prof. Dr.-Ing. Dr. h.c. G. Fettweis
Contents and objectives	Having completed the module, the students know and understand the basic structure of cellular mobile communications systems (system and protocol architectures, radio network planning and optimization, capacity calculation). They are able to analyze und to solve problems of radio network planning. They know the phenomena of the mobile radio channel (Doppler effect, multipath propagation), master the basic principles of digital signal transmission over frequency-selective and time-variant transmission channels and are able to analyze, to describe mathematically and to work out solutions for real-word data transmission problems.	
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 ET-12 10 24 Communications, Systems Theory, or equivalent.	
Requirements for the award of credit points	The credit points are earned if the module assessment is passed. If the number of registered students exceeds 15, the assessment consists of a written exam of 150 minutes. With up to 15 registered students, the writtem exam will be replaced by an oral exam of 45 minutes.	
ECTS credit points and grades	7 ECTS credit points 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
ET-12 10 16	Digital Signal Processing and Hardware Implementation	Prof. Dr.-Ing. Dr. h.c. G. Fettweis
Contents and objectives	Having completed the module, the students master processes for software implementation of digital signal processing algorithms on different hardware platforms and can evaluate them with respect to various criteria. The students know methods for hardware and software realization of communications engineering problems as well as design and optimization methods for digital signal processing systems. They are able to design and optimize signal processing systems in the field of communications by taking into account the mutual influence of the hardware and software (HW / SW co-design).	
Modes of teaching and learning	2 hours per week lectures, 1 hours per week tutorial, 2 hours per week practical lab courses, and self-study. The language of instruction is at least partially in English.	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, ET-12 10 24 Communications, Systems Theory.	
Requirements for the award of credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two exams. Exam 1 is a written exam of 120 minutes if the number of participants exceeds 16. With up to 16 participants, the written exam will be replaced by an oral exam as an individual exam of 20 minutes. The type of exam will be announced at the end of the registration period at the faculty. Exam 2 is a lab report.	
ECTS credit points and grades	7 ECTS credit points The module grade results from the arithmetic mean of the grades of both elements of assessment.	
Frequency	annually, beginning in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 10 16	Digital Signal Processing and Hardware Implementation	Prof. Dr.-Ing. Dr. h.c. G. Fettweis
Contents and objectives	Having completed the module, the students master processes for software implementation of digital signal processing algorithms on different hardware platforms and can evaluate them with respect to various criteria. The students know methods for hardware and software realization of communications engineering problems as well as design and optimization methods for digital signal processing systems. They are able to design and optimize signal processing systems in the field of communications by taking into account the mutual influence of the hardware and software (HW / SW co-design).	
Modes of teaching and learning	2 hours per week lectures, 1 hours per week tutorial, 2 hours per week practical lab courses, and self-study. The language of instruction is at least partially in English.	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, ET-12 10 24 Communications, Systems Theory.	
Requirements for the award of credit points	The credit points are earned if the module assessment is passed. The module assessment consists of two exams. Exam 1 is a written exam of 120 minutes if the number of participants exceeds 16. With up to 16 participants, the written exam will be replaced by an oral exam as an individual exam of 20 minutes. The type of exam will be announced at the end of the registration period at the faculty. Exam 2 is a lab report.	
ECTS credit points and grades	7 ECTS credit points The module grade results from the arithmetic mean of the grades of both elements of assessment.	
Frequency	Annually, beginning in the summer semester	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 10 17	Upgrade Mobile Communications Systems	Prof. Dr.-Ing. Dr. h.c. G. Fettweis
Contents and objectives	Contents of the module are special and/or current topics in the field of mobile communications. The student has the option to choose two lectures from a catalogue of several lectures. Examples of contents to choose from: 1. Fundamentals of Estimation and Detection 2. Machine Learning in signal processing 3. Algorithms for multi-antenna systems Objectives: Having completed this module, the students are able to understand the concepts of modern mobile systems and to contribute creatively to solve radio transmission problems under mobile communications conditions. The students have a deeper understanding of the problems in mobile communications (signal transmission via disturbed frequency-variant and time-variant communication channels), have the knowledge and skills to analyze these problems theoretically, to develop and implement practical solutions. The students are able to express themselves in English technical terminology.	
Modes of teaching and learning	The module includes lectures and tutorials in the amount of 6 hours per week, and self-study. The language of instruction is at least partly in English.	
Prerequisites	Competences acquired in modules such as ET-12 10 24 Communications, Systems Theory, or equivalent.	
Requirements for the award of credit points	The credit points are earned if the module assessment is passed. If the number of registered students exceeds 15, the module assessment is a written exam of 150 minutes. With up to 15 registered students, the written exam will be replaced by an oral exam as an individual exam of 45 minutes.	
ECTS credit points and grades	7 ECTS credit points 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
ET-12 10 18	Digital Signal Processing Systems	Prof. Dr.-Ing. Dr. h.c. G. Fettweis
Contents and objectives	Having completed the module, the students have the mathematical knowledge necessary for describing and analyzing discrete-time systems (e.g., fundamentals of time-discrete systems and spectral analysis of time, signal sampling and reconstruction, digital filtering, quantization, multirate systems, adaptive filtering), and can use this knowledge in the design and implementation of digital signal processing systems. The students are able to simulate signal processing modules and to implement them with the help of digital signal processors (DSPs).	
Modes of teaching and learning	3 hours per week lectures, 1 hour per week tutorials, 2 hours per week practical lab courses, and self-study.	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, Systems Theory, or equivalent.	
Requirements for the award of 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 a lab report.	
ECTS credit points and grades	7 ECTS credit point The module grade results from the weighted grades of the elements of assessment; the written exam contributes by 2/3 and the lab report by 1/3.	
Frequency	Annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
NES-12 10 08	Introduction to Optical Non-classical Computing: Concepts and Devices	Prof. Jamshidi
Contents and objectives	After the completion of the module the students know various optical computing methods. They know the basic principles of artificial neural networks, quantum computation, and Ising machines. Also, students know both linear and nonlinear photonic devices which are needed for the realization of these methods. Students can communicate in English	
Modes of teaching and learning	The module consists of 4 hours per week lectures and 2 hours per week practical training and self-study. The language of instruction is English	
Prerequisites	Knowledge on Bachelor Niveau of Electromagnetism, System theory, and Semiconductors.	
Usability	The module is an elective module for the Master's program of Nanoelectronic Systems	
Requirement for the award of credit points	The credit points are awarded if the module examination is passed.The credit points are awarded when the module assessment is passed. The module assessment consists of an assigned paper in the scope of 30 hours and an oral exam as individual exam worth 30 minutes.	
Credit points and grades	7 credit points can be earned by the module. The module grade is the unweighted average of the grade of the assigned paper and the grade of the oral exam M = (PL1 + PL2) / 2.	
Frequency	The module is offered every winter semester.	
Workload	The total effort is 210 hours.	
Duration	The module takes one semester	
Accompanied Literature	1. Quantum Computations and Quantum Information by M. Nielsen and I. L. Chuang 2. Adiabatic Quantum Computation and Quantum Annealing: Theory and Practice by C. C. McGeoch 3. Principles of Artificial Neural Networks by D. Graupe Other materials presented in the class	

Module number	Module name	Lecturer in charge
ET-12 10 21	Network Coding: Theory and Practice	Prof. Dr.-Ing. Frank Fitzek
Contents and objectives	Content: • Theoretical fundamentals of network coding (NC) • Evaluation of NC's performance in present and future communications systems Objectives: The students are able to cope with the joint treatment of coding and routing in networks. They know both the classic NC in wire-bound and the extension to the wireless case. They are familiar with current research topics in the fields of modulation and coding in networks as well as modern methods for data storage and secure data transmission, such as network coded modulation, lattice codes, compute-and-forward, distributed data storage and secure network coding. They know the performance of NC systems and are familiar with the simulation as well as the implementation of NC on simple communication systems.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study The language of instruction can either be German or English. At the beginning of the teaching period, the lecturer announces whether the module will be taught in English or German.	
Prerequisites	Competences acquired in modules such as Information Theory, Systems Theory, Communication Networks, Basics or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. If the number of registered students exceeds 15, the assessment consists of two written exams of 120 minutes each. With up to 15 registered students, the written exams will be replaced by two oral exams as individual exams of 30 minutes each.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of the grades for both elements of assessment.	
Frequency	Annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 10 22	Cooperative Communications	Prof. Dr.-Ing. Eduard Jorswieck
Contents and objectives	Content: • Modern methods of resource allocation in radio systems • Their application to cooperative communication systems Objectives: The knowledge of approaches and methods of game theory makes it possible to analyse conflict situations such as occur in resource allocation in radio systems. The students are familiar with the fundamental mathematical tools of the game theory and master their application in cooperative and non-cooperative systems in the field of mobile communication. They are familiar with example systems and the corresponding analytical and simulative approach, as well as the exemplary realisation by means of implementation on practical systems.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, and self-study. The language of instruction can be either German or English. At the beginning of the teaching period, the lecturer announces in which language the module will be taught.	
Prerequisites	Competences acquired in modules such as Information Theory, Systems Theory, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. If the number of registered students exceeds 15, the assessment consists of two written exams of 120 minutes each. With up to 15 registered students, the written exams can be replaced by oral exams of 30 minutes each.	
ECTS credit points and grades	7 ECTS credit points The module grade is the arithmetic mean of the grades for both elements of assessment.	
Frequency	Annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 11 01	Solid-State and Nano Electronics	Prof. Dr. rer. nat. et Ing. habil. Thomas Härtling
Contents and objectives	The module comprises: - **Solid-state electronics** with electronic functions based on di-, piezo-, pyro- and ferroelectricity, magnetic effects, electronic effects of plasmons and electron emission, - **Nanotechnology and nanoelectronics** of nanoelectronic devices (effects in nanodots and nanowires as well as effects taking place at very small numbers of charge carriers). Intended learning outcome: After successfully passing the module, students are able - to bring physically caused material effects to bear, - to apply probability-based theoretical basics of these effects, - to evaluate these effects, and - to use electronic and ionic effects for up-to-date electron devices.	
Modes of teaching and learning	4 hours per week lectures, 2 hours per week tutorials, self-study.	
Prerequisites	Competences acquired in modules such as ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, ET-01 04 04 Partial Differential Equations and Probability Theory, Materials Science and Engineering Mechanics, Microsystems and Semiconductor Technology, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. If the number of registered students exceeds 8, the module assessment consists of a written exam of 90 minutes. With up to 8 registered students, the module assessment consists of an oral exam as individual exam of 30 minutes.	
ECTS credit points and grades	7 ECTS credit points 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
ET-12 08 27	Neuromorphic VLSI Systems	Prof. Dr.-Ing. habil. Ch. G. Mayr
Contents and objectives	The content of the module includes: - Design Methods for Integrated Analog CMOS circuits and their circuit sizing, - neuromorphic VLSI systems and their neurobiological basics, common abstraction models, as well as the use in research and technology, eg. in brain-machine-interfaces and for signal processing, - foundations, concepts and methods for the preparation and analysis of analog and neuromorphic CMOS circuits with the design software Cadence DF2. Outcomes: After completing the module, students will be familiar with the areaof neuronal networks from neurobiological foundations up to to the application circuit. They are able to work with design tools (Cadence DF2, Specter), to design and dimension CMOS circuits, and to verify the parameters by simulation and to create associated circuit layouts.	
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 ET-12 08 01 Fundamentals of Electrical Engineering, ET-12 08 31 Electronic Circuits, ET-12 09 01 Systems Theory, ET-12 02 02 Numerical Analysis, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment consists of an assignment and a report.	
ECTS credit points and grades	7 ECTS credit points The module grade is the grade is the weighted mean of the parts of the assessment: M = (2 PL1 + PL2 / 3..	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 11 04	Sensors and Sensor Systems	Prof. Dr.-Ing. habil. G. Gerlach
Contents and objectives	The module comprises: - Physical effects connecting diverse measurands of sensors with electronic sensor quantities - Properties of sensors (material properties, transducer mechanisms, fabrication technology, construction of sensors, application requirements), - Design, application and operation of sensors Intended learning outcome: After successfully passing the module students are able - to apply physical basics of sensors, - to connect coupling effects and interferences caused by material properties, fabrication and application, - to estimate the impact of effects upon the sensor behaviour and to compare it with other influences, and - to use sensors for diverse applications.	
Modes of teaching and learning	Lectures, tutorials, and lab work with at least 6 hours per week (typically 4 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 ET-01 04 01 Introduction to Analysis and Algebra, ET-01 04 02 Calculus for Functions with Several Variables, ET-01 04 03 Complex Function Theory, ET-01 04 04 Partial Differential Equations and Probability Theory, Microsystems and Semiconductor Technology, 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 course.	
ECTS credit points and grades	7 ECTS credit points The module grade is calculated from the weighted mean of both the grade of the written exam (2/3) and the grade of the lab course (1/3).	
Frequency	annually, in the winter semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 11 05	Plasma Technology	Prof. Dr.-Ing. habil. G. Gerlach
Contents and objectives	The module includes plasma process for coating, surface treatment, surface modification, structuring and cleaning as well as separation of functional layers and layer systems. Outcomes: Students are able to work with the physical basics of plasmas in process plants, to chose the most important technical plasma sources and plasma processing systems as well as to classify the most important layers and layer systems from technical practice in the main applications.	
Modes of teaching and learning	4 hours per week lectures, 2 hour per week tutorials, and self-study.	
Prerequisites	Competences acquired in modules such as Basics of Science.	
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	7 ECTS credit points 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
ET-12 12 03	Applied Thin-Film and Solar Technology	Prof. Dr. rer. nat. J. W. Bartha
Contents and objectives	The module includes: - the production of electronic devices and solar cells by the vacuum-based generation of thin films Objectives: Having successfully completed this module, the students are familiar with: - the kineatic theory of gases - the generation of vacuum and vacuum measurement - the dimensioning of vacuum plants The students are capable of: - applying processes of thin film technology - using interactions between materials and the characteristics of the film - differentiating between the various types of solar cells and their manufacturing technologies - mastering the methods of process control - characterizing failure mechanisms of the devices	
Modes of teaching and learning	6 hours per week lectures and self-study.	
Prerequisites	Competencies acquired in modules such as Materials and Engineering Mechanics, Basics of Science, or equivalent.	
Requirements for the award of ECTS credit points	The credit points are earned if the module assessment is passed. The module assessment is an individual oral exam of 45 minutes.	
ECTS credit points and grades	7 ECTS credit points The grade of the module is the grade of the oral exam.	
Frequency	annually, in the summer semester	
Workload	210 hours	
Duration	1 semester	

Module number	Module name	Lecturer in charge
ET-12 12 04	Memory Technology	Prof. Dr.-Ing. T. Mikolajick
Contents and objectives	This module covers memory concepts in the market and in research respectively development stage: - Magnetic memories - Optival memories - Semiconductor memories (SRAM, DRAM, nonvolatile Memories (EPROM, EEPROM, Flash)) - Innovative semiconductor memories (e.g. ferroelectric, magnetoresistive, resisitive, organic, and single molecule memories) Objectives: After completion of the module the students have the competences to optimize and develop new generations of existing memory concepts. Based on the physical effects they will also be able to develop new memory concepts. Furthermore, the students are able to evaluate the areas of application for the memory concept and are aware of their limitation.	
Modes of teaching and learning	3 hours per week lectures, 2 hours per week seminars, and self-study. The module is taught in English.	
Prerequisites	Competencies acquired in modules such as ET-12 08 11 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. If the number of registered students exceeds 20, the module assessment consists of a written exam of 90 minutes. With up to 20 registered students, the written exam will be replaced by an oral exam as individual exam of 15 minutes.	
ECTS credit points and grades	7 ECTS credit points The grade of the module is the grade of the exam.	
Frequency	Annually, beginning in the summer semester	
Workload	210 working hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 13 11	Nonlinear Control Systems, Advanced	Prof. Dr.-Ing. habil. Klaus Röbenack
Contents and objectives	Content: • Mathematical tools of nonlinear systems (e.g. differential geometry) • System theoretical elements of complex control systems (e. g. spatially distributed systems) Objectives: The students are capable of analyzing complex control systems and dimension nonlinear control systems. They are able to model, identify, analyze, control and regulate complex control systems (e.g. spatially distributed systems) by means of mathematical and system theoretical correlations.	
Modes of teaching and learning	4 hours per week lectures, 1 hour per week tutorial, and self-study	
Prerequisites	Competences acquired in modules such as Systems Theory and Control of Continuous-Time Processes.	
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 90 minutes each.	
ECTS credit points and grades	7 ECTS credit points The module grade is determined by the arithmetic mean of both exams.	
Frequency	Annually The module starts in the summer semester.	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Lecturer in charge
ET-12 13 12	Optimal and Robust Multi-variable Control Systems	Prof. Dr.-Ing. habil. K. Röbenack
Contents and objectives	Content: 1. Analysis and design of optimal and / or robust control 2. Design of control concepts for multivariable systems or systems with model uncertainties Objectives: The students create optimal or robust controls and regulations (controller design). They are able to develop control concepts for multivariable systems or systems with model uncertainties, e.g. for the simultaneous influencing or decoupling of several sizes.	
Methods of teaching and learning	4 hours per week lectures, 1 hour per week tutorial, and self-study	
Prerequisites	Competences in the field of Control of Continuous-Time Processes.	
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 90 minutes.	
ECTS credit points and grades	7 ECTS credit points The module grade is determined by the arithmetic mean of both exams.	
Frequency	Annually The module starts in the summer semester.	
Workload	210 hours	
Duration	2 semesters	

Module number	Module name	Responsible lecturer
INF-BAS1	Introduction to Applied Computer Science	Prof. Dr. Martin Wollschlaeger martin.wollschlaeger@tu-dresden.de
Contents and qualification objectives	The students master the basic principles of engineering information technology in flexible automated systems according to the requirements of man and environment. The content of the module is chosen by the students: Methods for modeling and simulation, analysis and performance evaluation of complex dynamic systems, approaches to solve practical technical decision problems, specifics of networked systems or real-time systems, methods for planning and controlling complex technical systems, methods of design, specification and implementation of networked industrial application systems, methods for testing and trouble-shooting in software applications, techniques of task analysis and evaluation methods for the usable design of interactive systems.	
Teaching and learning methods	The module includes 4 SWS (semester weeks) lectures and 4 SWS exercises and the self-study. The language of the lectures and/or exercises can be German or English and will be determined at the beginning of the semester.	
Prerequisites for participation	Knowledge and skills in the basics of statistics, object-oriented programming, the basics of distributed systems, computer networks and software design are required. With the following literature, students can prepare for the module: Christian Ullenboom, Java is also an island: Learning programming with the standard work for Java developers, Rheinwerk Computing; Edition: 12, 2016, ISBN: 978-3836241199. Andrew s. Tanenbaum: Computer Networks. Prentice Hall, Pearson Education Germany. Alan Dix, Janet Finlay, Gregory D. Abowd: Human Computer Interaction, Prentice Hall, Pearson.	
Usability	The module is one of eight compulsory elective basic modules of the Master's programme in Computer Science, of which three are to be selected, one of seven compulsory elective basic modules of the Diploma programme in Computer Science, of which three are to be selected and one of four compulsory elective basic modules of the Diploma programme in Information Systems Engineering, of which one is to be selected. In the aforementioned Diploma programme in Computer Science, it fulfils the prerequisites for the compulsory elective advanced modules *Advanced Applied Computer Science* (INF-VERT1), *Introduction to Basic Research in Computer Science* (INF-PM-FOR) and *Introduction to Applied Research in*	

	Computer Science (INF-PM-ANW).
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. If there are more than 40 registered students, the module examination consists of a written examination with a duration of 90 minutes. If there are 40 or fewer registered students, it consists of an oral examination with a duration of 30 minutes; this will be announced to the registered students as usual at the faculty at the end of the registration period.
Credit points and grades	The module allows for the earning of 12 credit points. The module grade corresponds to the grade of the examination.
Frequency of the module	The module is offered each winter semester.
Workload	The workload is a total of 360 hours.
Duration of the module	The module takes one semester.

Module number	Module name	Responsible lecturer
INF-BAS2	Artificial Intelligence	Dr. Bjoern Andres bjoern.andres@tu-dresden.de
Contents and qualification objectives	The students understand the theory and master the methods for the independent conception, construction and programming of intelligent systems. Students are able to familiarize themselves with various topics in the field of artificial intelligence in both industry-related and research-oriented contexts and to apply their knowledge to solve problems independently. The content of the module is chosen by the students: Modelling and analysis of visual objects as well as methods of pattern recognition and computer vision, modeling and solution of complex problems with the help of declarative programming languages, ontology languages and other techniques of computational logic, theory of learning and advanced approaches in the field of machine learning and of statistical learning and methods for self-learning systems, techniques for solving planning and configuration problems as well as the combination of planning, decision theory and execution in rational agents and mobile robots, construction and methodology of autonomous robots, basic techniques for autonomous systems in complex systems that act rationally despite possible erroneous data and uncertain knowledge.	
Teaching and learning methods	The module includes lectures, exercises and seminars in the amount of 8 SWS (semester weeks) and the self-study. The courses are to be selected from the INF-BAS2 catalogue to the specified extent, including at least 2 SWS lectures and 2 SWS exercises. Some courses of this module can be offered in English. The catalogue will be announced as usual at the Faculty of Computer Science, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	Knowledge and skills in the basics of artificial intelligence (search methods, knowledge representation, machine learning) are required. With the following literature, students can prepare for the module: Russell & P. Norvig: Artificial Intelligence - A Modern Approach.	
Usability	In the Master's programme in Computer Science, the module is one of eight elective basic modules, of which three must be chosen and one of seven elective basic modules, of which three must be chosen in the Diploma programme in Computer Science.	

	This module fulfils the prerequisites for the following compulsory elective modules: *Advanced Artificial Intelligence* (INF-VERT2), *Introduction to Basic Research in Computer Science* (INF-PM-FOR) and *Introduction to Applied Research in Computer Science* (INF-PM-ANW) of the aforementioned Diploma programme.
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination, with a duration of 30 minutes. At the student's request, the oral examination may be conducted in English.
Credit points and grades	The module allows for the earning of 12 credit points. The module grade corresponds to the grade of the oral examination.
Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 360 hours.
Duration of the module	The module takes two semesters.

Module number	Module name	Responsible lecturer
INF-BAS3	Software and Web Engineering	Prof. Dr. Raimund Dachselt raimund.dachselt@tu-dresden.de
Contents and qualification objectives	The students master the basic principles of the engineering of software, web and multimedia applications and the associated processes. You can design, implement and evaluate simple applications with graphical and web-based interfaces. The content of the module is chosen by the students: Software Technologies, Web & Multimedia Engineering and Usability Engineering.	
Teaching and learning methods	The module includes lectures, exercises and seminars in the amount of 8 SWS (semester weeks) and the self-study. The courses are to be selected from the INF-BAS3 catalogue of the Faculty of Computer Science to the specified extent, including at least 2 SWS lectures and 2 SWS exercises. Some courses of this module can be offered in English. The catalogue will be announced as usual at the faculty, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	Skills and abilities in the basics of programming (e.g. in Java and JavaScript), software technology (e.g. UML) and markup languages (e.g. XML) are required. The following literature will help students to prepare for the module: Helmut Balzert, Textbook of Software Engineering, 2nd edition. Heidelberg, 2000, ISBN 3-8274-0042-2. Christian Ullenboom, Java is also an island: Learning programming with the standard work for Java developers, Rheinwerk Computing; Edition: 12, 2016, ISBN: 978-3836241199. Balzert, Helmut; Krüger, Sandra. HTML5, XHTML & CSS: Developing websites systematically & barrier-free - [2nd ed. Witten : W3L, 2011. ISBN: 9783937137544. http://katalogbeta.slub- dresden.de/id/0011609301/.	
Usability	The module is one of eight compulsory elective basic modules in the Master's programme in Computer Science, of which three are to be selected, one of seven compulsory elective basic modules in the Diploma programme in Computer Science, of which three are to be selected and one of four compulsory elective basic modules in the Diploma programme in Information Systems Engineering, of	

	which one is to be selected. It fulfils the prerequisites for the compulsory elective compulsory modules *Advanced Software and Web Engineering* (INF-VERT3) in the Master's and Diploma programmes in Computer Science and the prerequisites for the compulsory elective profile modules *Introduction to Basic Research in Computer Science* (INF-PM-FOR) and *Introduction to Applied Research in Computer Science* (INF-PM-ANW) in the Diploma programme in Computer Science.
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination with a duration of 30 minutes. At the student's request, the oral examination may be conducted in English.
Credit points and grades	The module allows for the earning of 12 credit points. The module grade corresponds to the grade of the oral examination grade.
Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 360 hours.
Duration of the module	The module takes one semester.

Module number	Module name	Responsible lecturer
INF-BAS4	System Architecture	Prof. Dr. Wolfgang Lehner wolfgang.lehner@tu-dresden.de
Contents and qualification objectives	The students have the technical and methodological competence to analyze, design, validate and operate system architectures not only under functional but also under non-functional aspects such as effort, costs, real time, fault tolerance, security and data protection. The content of the module is chosen by the students: Operating systems, databases, computer networks, fault tolerance, data protection and data security.	
Teaching and learning methods	The module includes lectures, exercises and seminars in the amount of 8 SWS (semester weeks) and the self-study. The courses are to be selected from the INF-BAS4 catalogue of the Faculty of Computer Science, to the specified extent, including at least 2 SWS lectures and 2 SWS exercises. Some courses of this module can be offered in English. The catalogue will be announced as usual at the faculty, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	Knowledge and skills in the basics of databases, computer networks, operating systems and security at Bachelor level are required. The following literature will help students to prepare for the module: Andrew S. Tanenbaum: Modern operating systems. Andrew S. Tanenbaum: Computer Networks. David Kahn: The Codebreakers: The Comprehensive History of Secret Communication from Ancient Times to the Internet. Theo Härder, Erhard Rahm: Database systems. Concepts and techniques of implementation.	
Usability	The module is one of eight compulsory elective basic modules in the Master's programme in Computer Science, of which three are to be selected, one of seven compulsory elective basic modules in the Diploma programme in Computer Science, of which three are to be selected and one of four compulsory elective basic modules in the Diploma programme in Information Systems Engineering, of which one is to be selected. In the aforementioned Diploma programme in Computer Science, it fulfils the prerequisites for the compulsory elective advanced and profile modules *Advanced*	

	System Architecture (INF-VERT4), *Introduction to Basic Research in Computer Science* (INF-PM-FOR) and *Introduction to Applied Research in Computer Science* (INF-PM-ANW)).
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination with a duration of 30 minutes. At the student's request, the oral examination may be conducted in English.
Credit points and grades	The module allows for the earning of 12 credit points. The module grade corresponds to the grade of the oral examination.
Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 360 hours.
Duration of the module	The module takes two semesters.

Module number	Module name	Responsible lecturer
INF-BAS5	Computer Engineering	Prof. Dr. Wolfgang Nagel wolfgang.nagel@tu-dresden.de
Contents and qualification objectives	Students know system architectures and modeling paradigms of VLSI systems, are able to verify descriptions of hardware systems by simulation and convert them into real circuits using typical tools. You know different implementation concepts for embedded systems and can describe them with formal means. They understand how the systems are embedded in their environment and how they are connected to it. You understand the interweaving of hardware and software in embedded systems and can derive design decisions from this. You know different approaches to formulate parallel programs. You understand how these formulations are mapped to different parallel computers and can estimate or evaluate the effects of program alternatives and architectural decisions. The contents of the module are design, modeling, programming, simulation and realization of technical systems in the fields of VLSI systems, embedded systems and parallel processing.	
Teaching and learning methods	The module includes lectures, exercises, practical courses and seminars in the amount of 8 SWS (semester weeks) and the self-study. The courses are to be selected from the INF-BAS5 catalogue of the Faculty of Computer Science, to the specified extent, including at least 2 SWS lectures, 2 SWS exercises and 2 SWS internships. Some courses of this module can be offered in English. The catalogue will be announced as usual at the faculty, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	Knowledge and skills in the basics of digital circuits, computer organization and computer architecture are required. The following literature will help students to prepare for the module: Lipp & Becker: Basics of digital technology. David Patterson (author), John LeRoy Hennessy: Computer organization and computer design: The hardware/software interface. Hennessy & Patterson: Computer Architecture. A Quantitative approach.	

Usability	The module is one of eight compulsory elective basic modules in the Master's programme in Computer Science, of which three are to be selected, one of seven compulsory elective basic modules in the Diploma programme in Computer Science, of which three are to be selected and one of four compulsory elective basic modules in the Diploma programme in Information Systems Engineering, of which one is to be selected. In the aforementioned Diploma programme in Computer Science, it fulfils the prerequisites for the compulsory elective advanced and profile modules *Advanced Computer Engineering* (INF-VERT5), *Introduction to Basic Research in Computer Science* (INF-PM-FOR) and *Introduction to Applied Research in Computer Science* (INF-PM-ANW).
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination with a duration of 30 minutes. A collection of minutes must be prepared as a preliminary examination performance.
Credit points and grades	The module allows for the earning of 12 credit points. The module grade corresponds to the grade of the oral examination.
Frequency of the module	The module is offered in the winter semester.
Workload	The workload is a total of 360 hours.
Duration of the module	The module takes one semester.

Module number	Module name	Responsible lecturer
INF- VERT1	Advanced Applied Computer Science	Prof. Dr. Martin Wollschlaeger martin.wollschlaeger@tu-dresden.de
Contents and qualification objectives	Students know advanced engineering methods for flexible automated systems over their entire life cycle. They can transfer engineering methods to novel application systems, apply them in an integrated way and develop components of such systems independently. The content of the module can be chosen by the students: Design and synchronization of multimodal user interfaces using visual, speech-based and haptic interaction techniques, assistive technologies, simulative performance evaluation of complex dynamic systems, industrial simulation projects including common statistical methods and modelling approaches, planning and control approaches from production and logistics, Resource scheduling problems, design of networked software systems including wireless networks and sensor-actuator networks and methods for modelling, specification, description, engineering and management of industrial communication systems, information models and systems for complex networked production systems.	
Teaching and learning methods	The module includes courses in the amount of 10 SWS (semester weeks) and the self-study. At least 4 SWS lectures and 2 SWS exercises are to be selected from the INF-VERT1 catalogue of the Faculty of Computer Science. 4 SWS lectures, exercises, seminars and internships listed in the catalogue can be freely selected. Some courses in this module may be offered in English. The catalogue will be announced as usual at the Faculty of Computer Science, at the beginning of each semester, including the language of the course.	
Prerequisites for participation	Competences to be acquired in the module INF-BAS1 Applied Computer Science, or equivalent.	
Usability	The module is one of seven compulsory elective advanced modules in the Master's programme in Computer Science, of which one is to be selected, and one of seven compulsory elective advanced modules in the Diploma programme in Computer Science, of which one is to be selected. It is also one of four compulsory elective advanced modules in the Diploma	

	programme in Information Systems Engineering, of which one must be selected.
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination performance, with a duration of 40 minutes. At the student's request, the oral examination may be conducted in English.
Credit points and grades	The module allows for the earning of 15 credit points. The module grade corresponds to the grade of the oral examination.
Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 450 hours.
Duration of the module	The module takes two semesters.

Module number	Module name	Responsible lecturer
INF- VERT2	Advanced Artificial Intelligence	Dr. Bjoern Andres bjoern.andres@tu-dresden.de
Contents and qualification objectives	The students are able to specify intelligent systems by means of formal methods, procedures and algorithms, they can prove properties of intelligent systems by means of formal methods, procedures and algorithms and they can introduce the used formal methods, procedures and algorithms into further applications. The contents of the module are as chosen by the students: Knowledge representation and inference, computational logic, pattern recognition and computer vision as well as bioinformatics.	
Teaching and learning methods	The module includes courses in the amount of in total 10 SWS (semester weeks) and the self-study. At least 4 SWS lectures and 2 SWS exercises are to be selected from the INF-VERT2 catalogue of the Faculty of Computer Science. 4 SWS lectures, exercises, seminars and internships listed in the catalogue are to be freely selected. Some courses in this module may be offered in English. The catalogue will be announced as usual at the Faculty of Computer Science, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	Competences acquired in the module INF-BAS2 Artificial Intelligence, or equivalent. Literature: Russel S. and Norvig, P.: Artificial Intelligence: A Modern Approach, Prentice Hall, 2009.	
Usability	In the Master's programme in Computer Science, the module is one of seven compulsory elective advanced modules of which one must be chosen, and one of seven compulsory elective advanced modules of which one must be chosen in the Diploma programme in Computer Science.	
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination performance with a duration of 40 minutes. At the student's request, the oral examination may be conducted in English.	
Credit points and grades	The module allows for the earning of 15 credit points. The module grade corresponds to the grade of the oral examination.	

Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 450 hours.
Duration of the module	The module takes two semesters.

Module number	Module name	Responsible lecturer
INF-VERT3	Advanced Software and Web Engineering	Prof. Dr. Raimund Dachselt raimund.dachselt@tu-dresden.de
Contents and qualification objectives	The students know advanced development methods and tools for the engineering of software, web, and Multimedia applications and the associated processes. With the help of modern frameworks, they can design and implement complex distributed applications with multimedia interfaces and evaluate their usability. The content of the module can be chosen by the students: Software technologies, web & multimedia engineering and usability engineering.	
Teaching and learning methods	The module includes courses in the amount of 10 SWS (semester weeks) and the self-study. At least 4 SWS lectures and 2 SWS exercises are to be chosen from the INF-VERT3 catalogue of the Faculty of Computer Science. 4 SWS lectures, exercises, seminars and internships listed in the catalogue can be freely chosen. Some courses of this module can be offered in English. The catalogue will be announced as usual at the faculty, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	Competences to be acquired in the module INF-BAS3 Software and Web Engineering, or equivalent.	
Usability	The module is one of seven compulsory elective advanced modules in the Master's programme in Computer Science, of which one is to be chosen, and one of seven comulsory elective advanced modules in the Diploma programme in Computer Science, of which one is to be chosen. It is also one of four compulsory elective advanced modules in the Diploma programme in Information Systems Engineering, of which one must be chosen.	
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination performance with a duration of 40 minutes. At the student's request, the oral examination may be conducted in English.	

Credit points and grades	The module allows for the earning of 15 credit points. The module grade corresponds to the grade of the oral examination.
Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 450 hours.
Duration of the module	The module takes two semesters.

Module number	Module name	Responsible lecturer
INF- VERT4	Advanced System Architecture	Prof. Dr. Wolfgang Lehner wolfgang.lehner@tu-dresden.de
Contents and qualification objectives	Students can independently develop new concepts and solutions for the analysis, design, validation and operation of complex system architectures. They consider both functional and non-functional aspects such as effort, costs, real time, fault tolerance, security and data protection. Furthermore, they are able to consider new research-oriented problems in this area under possible economic and social effects. The contents of the module can be chosen by the students: Operating systems, databases, computer networks, fault tolerance, data protection and data security.	
Teaching and learning methods	The module includes courses in the amount of 10 SWS (semester weeks) and the self-study. At least 4 SWS lectures and 2 SWS exercises are to be chosen from the INF-VERT4 catalogue of the Faculty of Computer Science. 4 SWS lectures, exercises, seminars and internships listed in the catalogue can be freely chosen. Some courses of this module can be offered in English. The catalogue will be announced as usual at the faculty, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	Competences to be acquired in the module INF-BAS4 System Architecture, in particular basic knowledge of databases (relational databases, Entity Relationship Model, XML data model), computer networks (transmission methods, network technologies, Internet protocol mechanisms), operating systems (memory and process management, quantitative methods, process communication) and security (multilateral security, protection targets, attack models, security mechanisms).	
Usability	The module is one of seven compulsory elective advanced modules in the Master's programme in Computer Science, of which one is to be chosen, and one of seven compulsory elective advanced modules in the Diploma programme in Computer Science, of which one is to be selected. It is also one of four compulsory elective advanced modules in the Diploma pro-gramme in Information Systems Engineering, of which one must be chosen.	

Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination performance with a duration of 40 minutes. At the student's request, the oral examination may be conducted in English.
Credit points and grades	The module allows for the earning of 15 credit points. The module grade corresponds to the grade of the oral examination.
Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 450 hours.
Duration of the module	The module takes two semesters.

Module number	Module name	Responsible lecturer
INF- VERT5	Advanced Computer Engineering	Prof. Dr. Wolfgang Nagel wolfgang.nagel@tu-dresden.de
Contents and qualification objectives	The students are able to develop new approaches for design, realization, use and evaluation of computer architectures and hardware implementations of technical systems by recombination and extension of known concepts. The contents of the module are as chosen by the students: Performance evaluation of computer systems; hardware and software techniques for parallel processing, design and testing of VLSI circuits, programmable circuits, computer arithmetic, hardware and software architecture of embedded systems; methods for hardware synthesis and efficient methods for code generation.	
Teaching and learning methods	The module includes courses in the amount of 10 SWS (semester weeks) and the self-study. At least 4 SWS lectures and 2 SWS exercises are to be chosen from the INF-VERT5 catalogue of the Faculty of Computer Science. 4 SWS lectures, exercises, seminars and internships listed in the catalogue can be freely chosen. Some courses of this module can be offered in English. The catalogue will be announced as usual at the faculty, at the beginning of each semester, including the language of the courses.	
Prerequisites for participation	The competences to be acquired in the module INF-BAS5 Computer Engineering, or equivalent.	
Usability	The module is one of seven compulsory elective advanced modules in the Master's program in Computer Science, of which one is to be chosen, and one of seven compulsory elective advanced modules in the Diploma programme in Computer Science, of which one is to be chosen. It is also one of four compulsory elective advanced modules in the Diploma programme in Information Systems Engineering, of which one must be chosen.	
Requirements for the awarding of credit points	The credit points are awarded if the module examination is passed. The module examination consists of an oral examination performance with a duration of 40 minutes.	

Credit points and grades	The module allows for the earning of 15 credit points. The module grade corresponds to the grade of the oral examination.
Frequency of the module	The module is offered each semester.
Workload	The workload is a total of 450 hours.
Duration of the module	The module takes two semesters.