B.Sc. Information System Technology, Mandatory areas (PO 2023)

Module handbook
FB 18
Date: 01.09.2023

TECHNISCHE UNIVERSITÄT DARMSTADT

FB 18

Module handbook: B.Sc. Information System Technology, Mandatory areas (PO 2023)

Date: 01.09.2023

FB 18
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Contents

1 Fundamentals

1.1 Fundamentals of Mathematics

Module name Mathematics I (Electrical Engineering)					
Module nr. 04-00-0108	**Credit points** 8 CP	**Workload** 240 h	**Self-study** 150 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Apl. Prof. Dr. rer. nat. Steffen Roch		
1	**Teaching content** Basics, real and complex numbers, real funktions, continuity, differential and integral calculus in one variable, vector spaces, linear mappings, systems of linear equations				
2	**Learning objectives**				
3	**Recommended prerequisites for participation**				
4	**Form of examination** Module exam: • Module exam (Technical examination, Oral/written examination, Default RS) Usually the exam is taken in form of a written test (90 min), except when there are only a small number of potential participants. In this case, the exam can be taken in the form of an oral exam (30 min). The decision about the form of the exam is taken and communicated during the first two weeks of the lecture, based on the prospective number of students taking the exam.				
5	**Prerequisite for the award of credit points** Passing the final module examination				
6	**Grading** Module exam: • Module exam (Technical examination, Oral/written examination, Weighting: 100 %)				
7	**Usability of the module** Für B.Sc.ETiT, B.Ed.ETiT, B.Sc.WIETiT, B. Sc. Mec, B. Sc. CE, B. Sc. IST, B. Sc. MedTech				
8	**Grade bonus compliant to §25 (2)**				
9	**References**				
Courses					

	Course nr. 04-00-0126-vu	**Course name** Mathematics I (Electical Engineering)		
	Instructor Apl. Prof. Dr. rer. nat. Steffen Roch		**Type** Lecture and practice	**SWS** 6

Module name Mathematics II (Electrical Engineering)					
Module nr. 04-00-0109	**Credit points** 8 CP	**Workload** 240 h	**Self-study** 150 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Apl. Prof. Dr. rer. nat. Steffen Roch		

1	**Teaching content** Determinants, eigenvalues, quadratic forms, sequences and series of functions, Taylor and Fourier series, differentiala calculus in R^n, extrema, inverse and implicit functions, path integrals, integration in R^n
2	**Learning objectives**
3	**Recommended prerequisites for participation** Recommended: Mathematik I (für ET)
4	**Form of examination** Module exam: • Module exam (Technical examination, Oral/written examination, Default RS) Usually the exam is taken in form of a written test (90 min), except when there are only a small number of potential participants. In this case, the exam can be taken in the form of an oral exam (30 min). The decision about the form of the exam is taken and communicated during the first two weeks of the lecture, based on the prospective number of students taking the exam.
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Oral/written examination, Weighting: 100 %)
7	**Usability of the module** B.Sc.ETiT, B.Ed.ETiT, B.Sc.WIETiT, B. Sc. Mec, B. Sc. CE, B. Sc. IST, B. Sc. MedTech
8	**Grade bonus compliant to §25 (2)**
9	**References**

Courses

	Course nr. 04-00-0079-vu	**Course name** Mathematics II (Electrical Engineering)		
	Instructor Apl. Prof. Dr. rer. nat. Steffen Roch		**Type** Lecture and practice	**SWS** 6

Module name
Mathematics III (Electrical Engineering)

Module nr.	Credit points	Workload	Self-study	Module duration	Module cycle
04-00-0111	8 CP	240 h	150 h	1 Term	Winter term

Language	Module owner
German	Apl. Prof. Dr. rer. nat. Steffen Roch

1 Teaching content
integral calculus: surface integrals, integral theorems; ordinary differential equations: linear and non-linear differential equations, existence and uniqueness of solutions, elementary techniques, linear systems with constant coefficients, Laplace transform; Complex Analysis: complex functions, complex differentiation, Cauchy's integral formula, power series and Laurent series, residues, residue theorem

2 Learning objectives

3 Recommended prerequisites for participation
Recommended: Mathematik I und Mathematik II (für ET)

4 Form of examination
Module exam:
- Module exam (Technical examination, Oral/written examination, Default RS)

Usually the exam is taken in form of a written test (90 min), except when there are only a small number of potential participants. In this case, the exam can be taken in the form of an oral exam (30 min). The decision about the form of the exam is taken and communicated during the first two weeks of the lecture, based on the prospective number of students taking the exam.

5 Prerequisite for the award of credit points
Passing the final module examination

6 Grading
Module exam:
- Module exam (Technical examination, Oral/written examination, Weighting: 100 %)

7 Usability of the module
B.Sc.ETiT, B.Ed.ETiT, B.Sc.WIETiT, B. C. MedTech, B.Sc.MEC, B.Sc.CE, B.Sc.IST

8 Grade bonus compliant to §25 (2)

9 References

Courses

Course nr.	Course name
04-00-0127-vu	Mathematics III (Electrical Engineering)

Instructor	Type	SWS
Apl. Prof. Dr. rer. nat. Steffen Roch	Lecture and practice	6

Module name Statistics/Probability Theory					
Module nr. 04-10-0602	**Credit points** 4 CP	**Workload** 120 h	**Self-study** 75 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Prof. Dr. rer. nat. Stefan Ulbrich		

1	**Teaching content**
2	**Learning objectives**
3	**Recommended prerequisites for participation**
4	**Form of examination** Module exam: • Module exam (Technical examination, Examination, Duration: 90 Min., Default RS)
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module**
8	**Grade bonus compliant to §25 (2)**
9	**References**

Courses

	Course nr. 04-10-0602-vu	**Course name** Statistics/Probability Theory		
	Instructor		**Type** Lecture and practice	**SWS** 3

Module name Scientific Computing (EE)					
Module nr. 04-10-0603	**Credit points** 4 CP	**Workload** 120 h	**Self-study** 75 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Prof. Dr. rer. nat. Stefan Ulbrich		

1	**Teaching content**
2	**Learning objectives**
3	**Recommended prerequisites for participation**
4	**Form of examination** Module exam: • Module exam (Technical examination, Examination, Duration: 90 Min., Default RS)
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module**
8	**Grade bonus compliant to §25 (2)**
9	**References**

Courses

Course nr. 04-10-0603-vu	**Course name** Scientific Computing		
Instructor		**Type** Lecture and practice	**SWS** 3

Module name Software Lab Scientific Computing					
Module nr. 18-sc-1030	**Credit points** 3 CP	**Workload** 90 h	**Self-study** 60 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Prof. Dr. rer. nat. Sebastian Schöps		

1	**Teaching content** Numerical algorithms: numerical solution of linear systems of equations, interpolation, numerical quadrature methods, nonlinear systems of equations, initial value problem for ordinary differential equations, eigenvalue/eigenvector computation.
2	**Learning objectives** After completion of the module, fundamental algorithms of numerics are understood and can be prototypically implemented and automatically tested in software by the students.
3	**Recommended prerequisites for participation** Mathematics 1, Mathematics 2, Mathematics 3 (in parallel)
4	**Form of examination** Module exam: • Module exam (Study achievement, Oral/written examination, p/np RS) Report (including submission of programming code) and/or Presentation and/or Oral examination (25 minutes) and/or Colloquium (testate), but never more than two out of it. The type of examination will be announced in the beginning of the lecture.
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Study achievement, Oral/written examination, Weighting: 100 %)
7	**Usability of the module**
8	**Grade bonus compliant to §25 (2)**
9	**References**

Courses

Course nr. 18-sc-1030-pr	**Course name** Software lab scientific computing		
Instructor Prof. Dr. rer. nat. Sebastian Schöps		**Type** Internship	**SWS** 2

1.2 Fundamentals of Electrical Engineering and Information Technology

1.2.1 Electrical Engineering

Module name Electrical Engineering and Information Technology II					
Module nr. 18-gt-1020	**Credit points** 7 CP	**Workload** 210 h	**Self-study** 135 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Prof. Dr.-Ing. Gerd Griepentrog		

1	**Teaching content** Electrostatic fields; stationary electrical flow fields; stationary magnetic fields; temporally variable magnetic fields; capacitor networks, transmission lines
2	**Learning objectives** Upon successful completion of the module the students have detached themselves from the conception that all electrical procedures are line-bound; they have a clear idea of the field term, can read and interpret field plots and also design simple field plots themselves; they understand the difference between a curl and a divergence field, can describe this difference mathematically and are able to recognize the field type from a mathematical description, respectively; they are able to calculate field distributions for simple rotationally symmetric arrangements analytically; they can deal surely with the definitions of the electrostatic, the electrical quasi-static, the magnetostatic and the magneto-electric field; they have recognized the connection and dualism of electricity and magnetism; they control the mathematical apparatus necessary for their description and can apply it to simple examples; they can calculate with nonlinear magnetic circuits; they can compute inductance, capacity and resistance of simple geometrical arrangements and understand them now as physical characteristics of the respective arrangement; they have recognized, how different forms of energy can be transferred into each other and are thereby already able to solve simple scientific engineering problems; they have understood the underlying physical backgrounds for many applications of electrical engineering and are able to describe them mathematically, develop it further in a simple way and apply it to other examples; they are familiar with the system of Maxwell's equations in their integral representation have a first idea of the importance of Maxwell's equations for all conceptual formulations of electrical engineering. They understand the propagation of electromagnetic waves in the free space and on transmission lines for both harmonic ans transient signals.
3	**Recommended prerequisites for participation** Electrical Engineering and Information Technology I
4	**Form of examination** Module exam: • Module exam (Technical examination, Examination, Duration: 120 Min., Default RS)
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module** BSc ETiT, BSc MEC, BSc Wi-ETiT, LA Physik/Mathematik, BSc CE, BSc iST
8	**Grade bonus compliant to §25 (2)** Notenverbesserung entsprechend 25 (2) APB TU Darmstadt
9	**References**

- Downloadable slides
- Clausert, Wiesemann, Hinrichsen, Stenzel: „Grundgebiete der Elektrotechnik I und II“; ISBN 978-3-486-59719-6
- Prechtl, A.: „Vorlesungen über die Grundlagen der Elektrotechnik - Band 2“ ISBN: 978-3-211-72455-2

Courses

Course nr.	**Course name**		
18-gt-1020-vl	Electrical Engineering and Information Technology II		
Instructor		**Type**	**SWS**
Prof. Dr.-Ing. Gerd Griepentrog		Lecture	3
Course nr.	**Course name**		
18-gt-1020-ue	Electrical Engineering and Information Technology II		
Instructor		**Type**	**SWS**
M.Sc. Daniel Großmann, Prof. Dr.-Ing. Gerd Griepentrog		Practice	2

Module name Electrical Engineering and Information Technology Lab I					
Module nr. 18-kn-1040	**Credit points** 4 CP	**Workload** 120 h	**Self-study** 60 h	**Module duration** 2 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr. Mario Kupnik		

1 Teaching content

After a safety instruction for electrical equipment, students dolab experiments covering foundations of electrical engineering by using theoretical and experimental instructions to improve basic electrical understanding. Building up a test set autonomously and performing of measurements and evaluations in the form of logs to confirm the theoretical knowledge and lead to independent work in practice.
The following experiments are performed:

- Investigate real behavior of ohmic resistors
- Investigate real behavior of capacitors and inductors
- Calculate impedances of basic two-terminal circuits using network theory
- Measure of electrical power in AC circuits and investigate in the real behaviour of transformers
- DC technology, capacity and inductors, AC technology - Impedances and two-terminal circuits, transformer & power;

2 Learning objectives

After preparing the afternoons independently and self-implementing the measurement setup and measurement tasks by active participation in the practical group and by thorough preparation of the associated measurement protocols, you should be able to:

1. Perform the measurement of basic electrical parameters of DC and AC circuits, independently and in compliance with safety rules
2. measuring the frequency response of passive electrical networks and resonant circuits, and electric power measurement
3. the measurement of circuits for the determination of magnetic, electro-thermal and high-frequency. You have to be able to build and run your own measurements
4. interpretations of the measurement results in terms of its technical meaning, but also their accuracy and error sources safely.

3 Recommended prerequisites for participation

Parallel attending the lectures and exercises, "Electrical Engineering I and II"

4 Form of examination

Module exam:

- Module exam (Study achievement, Optional, Default RS)

5 Prerequisite for the award of credit points

Passing the final module examination

6 Grading

Module exam:

- Module exam (Study achievement, Optional, Weighting: 100 %)

7 Usability of the module

BSc ETiT

8 Grade bonus compliant to §25 (2)

9	**References** detailed script with instructions for the experiments; Clausert, H. / Wiesemann, G.: Grundgebiete der Elektrotechnik, Oldenbourg,1999			
Courses				
	Course nr. 18-kn-1040-pr	**Course name** Electrical Engineering and Information Technology Lab I A		
	Instructor Prof. Dr. Mario Kupnik		**Type** Internship	**SWS** 2
	Course nr. 18-kn-1041-pr	**Course name** Electrical Engineering and Information Technology Lab I B		
	Instructor Prof. Dr. Mario Kupnik		**Type** Internship	**SWS** 2
	Course nr. 18-kn-1040-tt	**Course name** Electrical Engineering and Information Technology I, Safety instructions and rules		
	Instructor Prof. Dr. Mario Kupnik		**Type** Tutorial	**SWS** 0

1.2.2 Information Technology

Module name Deterministic Signals and Systems					
Module nr. 18-kl-1010	**Credit points** 7 CP	**Workload** 210 h	**Self-study** 135 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr.-Ing. Anja Klein		

1	**Teaching content** Examples of signals and systems, Specific signals, generalized functions, impulse function, step function, time represenation of signals and systems, linear time invariant systems, impulse response, convolution Fourier Series: Motivation; Fourier series with real coefficients; Fourier series with complex coefficients; properties of the Fourier series, convegence conditions, examples and applications Fourier Transform: Motivation - Deriviation from Fourier series - Dirichlet conditions - generalized functions, delta function - step function - properties of Fourier-transform - special cases - examples and applications,expansion into partial fractions Representation of signals and systems in frequency domain, Time invariant systems, convolutions theorem,- Parseval's theorem - properties-examples and applications Systems and Signals: Bandlimited and time limited systems - systems with only one energy store - examples and applications Laplace Transform: Motivation - single sided L-transform - inverse L-transform - theorems of L- transform - examples and applications Linear differential equations: Time invariant systems,equivalent circuits for passive electrical elements - examples and applications Discrete signals: series of numbers, relationship discrete and continuous signals, impulse sequence, step sequence, exponential sequence, periodicity in frequency and time. z-Transform: motivation, relationship to Laplace-Transform, definition one-sided z-Transform, convergence, examples and applications, properties of the z-Transform, discrete convolution, inverse z-Transform, partial fraction expansion. Discrete Systems: general description, properties, LTI systems, impulse response, step response, connection of systems, linear difference equations, discrete time and image area, transfer function, block diagrams, IIR- and FIR-systems. Signal Sampling and Reconstruction: ideal sampling and reconstruction in time and frequency domain, sampling theorem, practical aspects. Discrete-Time Fourier Transform (DTFT): motivation, relationship to Fourier-Transform, definition of DTFT, examples and applications, properties, inverse transform, system description via DTFT, Parseval‘s Theorem. Discrete Fourier Transform (DFT): motivation, relationship to DTFT, definition of DFT, examples and applications, properties, inverse transform, practical aspects, cyclic convolution.
2	**Learning objectives** The students should understand the principles of integral transformations and discrete transformations and be able to apply them to physical and technical problems. The students shall be able to mathematically describe and analyse continuous and discrete signals and systems (LTI) in time domain and in the corresponding image area. The techniques of this module are essential tools which will be needed in many follow-up modules.
3	**Recommended prerequisites for participation** Elektrotechnik und Informationstechnik I und Elektrotechnik und Informationstechnik II
4	**Form of examination** Module exam: • Module exam (Technical examination, Examination, Duration: 120 Min., Default RS)
5	**Prerequisite for the award of credit points**

	Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module** BSc ETiT, BSc MEC, BSc Wi-ETiT, LA Physik/Mathematik, BSc CE, BSc iST
8	**Grade bonus compliant to §25 (2)** Yes, if not feasible in presence
9	**References** The slides of the lecture, documentation for the exercises and numerous additional documents will be provided in electronic form. Basic Literature: • A. Fettweis, Elemente nachrichtentechnischer Systeme, Teubner Verlag, 2. Auflage, Stuttgart/Leipzig, 1996. • S. Soliman and M.D. Srinath, Continuous and Discrete Signals and Systems, Prentice Hall, New Jersey, 1990. • T. Frey, M. Bossert, Signal- und Systemtheorie, Teubner Verlag, 2004 • H. Clausert, G. Wiesemann "Grundgebiete der Elektrotechnik 2", Oldenbourg, 1993. • Otto Föllinger "Laplace-, Fourier- und z-Transformation", Hüthig, 2003. • Exercises: • Hwei Hsu "Signals and Systems", Schaum's Outlines, 1995

Courses

Course nr. 18-kl-1010-vl	**Course name** Deterministic Signals and Systems		
Instructor Prof. Dr.-Ing. Marius Pesavento, Prof. Dr.-Ing. Anja Klein		**Type** Lecture	**SWS** 3
Course nr. 18-kl-1010-ue	**Course name** Deterministic Signals and Systems		
Instructor Prof. Dr.-Ing. Marius Pesavento, Prof. Dr.-Ing. Anja Klein, M.Sc. Maximilian Wirth		**Type** Practice	**SWS** 2

Module name Fundamentals of Communication					
Module nr. 18-jk-1010	**Credit points** 6 CP	**Workload** 180 h	**Self-study** 120 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Prof. Dr.-Ing. Rolf Jakoby		

1 Teaching content

Part 1 Fundamentals of Signal Transmission: Chap. 1 will be a brief introduction in "Electrical Information- and Communication Engineering", presenting signals as carrier of information, classifying electrical signals and describing elements of communication systems. Then, Chap. 2 introduces various line-conducted and wireless transmission media, power budget calculations for both media types, basics of antenna radiation and parameters etc., which will be emphasized by application examples like TV-satellite reception and mobile communication channels.
Chap. 3 is focused on signal distortions and interferences, especially thermal noise, considering noisy two-port devices and its concatenations, lossy networks, antenna noise temperature and the impact of noise on analog and digital signals. This chap. ends with basics of information theory and channel capacity for AWGN-channels. In contrast, chap 4 deals with some fundamentals of noise-reduction and distortion-compensation techniques.

Part 2 Digital Baseband-Signal Processing: Chap. 5 introduces sampling of band-limited signals and analog modulation of a pulse carrier (pulse-amplitude-, pulse-duration- and pulse-angle-modulation), which will be extended in chapter 6 on digital modulation in the baseband by means of pulse-code modulation (PCM), focusing on signal quantizing, analog-digital conversion, minimum bandwidth, bit error rate and error probability of a PCM word. At least, PCM-time-division multiplex and -systems will be discussed. Chap. 7 introduces band-limited inter-symbol interference-free transmission and matched filtering in the baseband.

Part 3 Analog Radio Frequency (RF) Signal Processing: Chap. 8 deals with fundamentals of multiplex- and RF-modulation schemes as well as with frequency conversion, frequency multiplication and mixing strategies. Then, receiver principles and image frequency problems of heterodyne-receivers as well as amplitude modulation of a sinus carrier will close this chapter. Chap. 9 introduces digital modulation of a harmonic carrier, including binary shift keying of a sinusoidal carrier in amplitude (ASK), phase (PSK) or frequency (FSK) as well as higher-order modulation schemes like M-PSK and M-QAM. At the end, there will be a comparison of the bandwidth and power efficiency of these modulation schemes. Then in chapter 10, a brief outlook on the functionality of channel coding and interleaving is given in order to assess the performances of digital communication systems, which requires most of the learned content of this lecture.

2 Learning objectives

Aim of the Lecture: To teach the fundamentals of communications (physical layer), primarily the transmission of signals from a source to a sink, possible modulation and access methods, signal distortion and noise as well as how to determine the performances of digital communication systems. The introduction of communications is a basement for further lectures like Communication Technology, Laboratories of Communication Technology (NTP A, B), Microwave Eng., Optical Communications and Mobile Communications.

3 Recommended prerequisites for participation

Deterministic Signals and Systems

4 Form of examination

Module exam:

- Module exam (Technical examination, Examination, Duration: 120 Min., Default RS)

5 Prerequisite for the award of credit points

Passing the final module examination

6 Grading

	Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module** BSc ETiT, Wi-ETiT
8	**Grade bonus compliant to §25 (2)**
9	**References** Complete Script and Literature: • Pehl, E.: Digitale und analoge Nachrichtenübertragung, Hüthig Verlag • Meyer, Martin: Kommunikationstechnik, Vieweg • Stanski, B.: Kommunikationstechnik • Kammeyer, K.D.: Nachrichtenübertragung. B.G. Teubner • Mäusl, R.: Digitale Modulationsverfahren. Hüthig Verlag • Haykin, S.: Communication Systems. John Wiley • Proakis, J., Salehi M.: Communication Systems Engineering. Prentice Hall • Ziemer, R., Peterson, R.: Digital Communication. Prentice Hall • Cheng, D.: Field and Wave Electromagnetics, Addision-Wesley.

Courses

Course nr. 18-jk-1010-vl	**Course name** Fundamentals of Communications		
Instructor Prof. Dr.-Ing. Rolf Jakoby		**Type** Lecture	**SWS** 3
Course nr. 18-jk-1010-ue	**Course name** Fundamentals of Communications		
Instructor Prof. Dr.-Ing. Rolf Jakoby		**Type** Practice	**SWS** 1

Module name Electronics					
Module nr. 18-ho-1010	**Credit points** 4 CP	**Workload** 120 h	**Self-study** 75 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr.-Ing. Klaus Hofmann		

1 Teaching content

Semiconductor Devices: Diode, MOSFET, Bipolar Transistor; Design of Electronic Circuits;
Analog Circuits: Basic Properties, Properties and Application of Operational Amplifiers, Circuit Simulation with SPICE, Small Signal Gain, Single Stage Amplifiers; Frequency Response;
Digital Circuits: CMOS Logic Circuits

2 Learning objectives

A student is, after successful completion of this module, able to

1. analyse Diodes, MOS- und Bipolartransistors in simple circuits
2. calculate the properties of single transistor circuits, such as small signal gain, input and output resistance
3. design inverting and non-inverting amplifiers from operational amplifiers and knows their ideal and non-ideal properties
4. calculate the frequency behavior of simple transistor circuits
5. distinguish the different methods to construct a logical gate from basic transistors and explain their fundamental properties.

3 Recommended prerequisites for participation

Basics of Electrical Engineering

4 Form of examination

Module exam:

- Module exam (Technical examination, Examination, Duration: 90 Min., Default RS)

5 Prerequisite for the award of credit points

Passing the final module examination

6 Grading

Module exam:

- Module exam (Technical examination, Examination, Weighting: 100 %)

7 Usability of the module

BSc ETiT, BSc Wi-ETiT,BSc iST, BEd

8 Grade bonus compliant to §25 (2)

A grade improvement of up to 0,4 due to a bonus is possible, which can be earned with tests.

9 References

Lecture Slide Copies; Richard Jaeger: Microelectronic Circuit Design

Courses

Course nr.	**Course name**		
18-ho-1011-vl	Electronics		
Instructor		**Type**	**SWS**
Prof. Dr.-Ing. Klaus Hofmann, M.Sc. Oliver Bachmann		Lecture	2

	Course nr. 18-ho-1011-ue	**Course name** Electronics		
	Instructor Prof. Dr.-Ing. Klaus Hofmann, M.Sc. Oliver Bachmann		**Type** Practice	**SWS** 1

Module name Electronics Lab					
Module nr. 18-ho-1030	**Credit points** 3 CP	**Workload** 90 h	**Self-study** 60 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr.-Ing. Klaus Hofmann		

1	**Teaching content** Lab experiments on: • Digital Circuits: FPGA programming • Analog Ciruits: Basic Components, Amplifiers, Operational Amplifiers, Filters and Demodulators
2	**Learning objectives** A student is, after successful completion of this module, able to • perform measurement on operational amplifier circuits in the time- and frequency domain using an oscilloscope • design a traffic light controller using state diagrams and download the program to a FPGA,
3	**Recommended prerequisites for participation** Basics of Electrical Engineering; Lecture "Electronics" which is running in parallel
4	**Form of examination** Module exam: • Module exam (Study achievement, Examination, Duration: 60 Min., Default RS)
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Study achievement, Examination, Weighting: 100 %)
7	**Usability of the module** BSc ETiT, WI-ETiT
8	**Grade bonus compliant to §25 (2)**
9	**References** Slide Copies of Lecture "Electronics"; Richard Jaeger: Microelectronic Circuit Design

Courses

	Course nr. 18-ho-1011-pr	**Course name** Electronics Lab		
	Instructor Prof. Dr.-Ing. Klaus Hofmann, Dr.-Ing. Ferdinand Keil		**Type** Internship	**SWS** 2
	Course nr. 18-ho-1030-ev	**Course name** Electronics Lab - Introductory Meeting		
	Instructor Prof. Dr.-Ing. Klaus Hofmann		**Type** Introductory course	**SWS** 0

1.3 Foundations of Computer Science

Module name Functional and Object-oriented Programming Concepts					
Module nr. 20-00-0004	**Credit points** 10 CP	**Workload** 300 h	**Self-study** 180 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr. phil. nat. Marc Fischlin		

1 Teaching content

Basic competences in science-based, problem-oriented development of software systems. Introduction to basic terms and principles of computer science. Development of essential programming skills. Understanding the role of abstraction and modeling in the field of computer science.

The main topics are:

- Basic concepts of programming languages
- Foundations of functional programming languages
- Foundations of object-oriented programming languages
- Design and implementation of small software systems
- Basic type systems
- Fundamental data structures and algorithms and their complexity
- Recursion
- Simple I/O
- Basics of testing
- Documenting source code

2 Learning objectives

After successfully completing the module, the students are familiar with the foundations of functional and object-oriented programming languages and they are able to perform the following tasks:

- systematically solve small programming tasks using functional and/or object-oriented programming language concepts;
- perform quality assurance using basic (unit) tests;
- document source code using standard tools.

3 Recommended prerequisites for participation

4 Form of examination

Course related exam:

- [20-00-0004-iv] (Technical examination, Oral/written examination, Default RS)
- [20-00-0004-iv] (Study achievement, Oral/written examination, p/np RS)

See german description.

5 Prerequisite for the award of credit points

Pass exam (100%)

6 Grading

Course related exam:

- [20-00-0004-iv] (Technical examination, Oral/written examination, Weighting: 100 %)
- [20-00-0004-iv] (Study achievement, Oral/written examination, Weighting: 0 %)

7 Usability of the module

	B. Sc. Informatik B.Sc. Wirtschaftsinformatik JBA Informatik B.Sc. Informationssystemtechnik B.Sc. Computational Engineering Lehramt an Gymnasien - Fach Informatik Bachelor/Master of Education mit beruflicher Fachrichtung oder Unterrichtsfach Informatik May be used in other degree programs.
8	**Grade bonus compliant to §25 (2)** In dieser Veranstaltung findet eine Anrechnung von vorlesungsbegleitenden Leistungen statt, die lt. 25(2) der 6. Novelle der Allgemeinen Prüfungsbestimmungen der TU Darmstadt und den vom Fachbereich Informatik am 14.07.2022 beschlossenen Anrechnungsregeln zu einer Notenverbesserung um bis zu 1.0 führen kann.
9	**References** Will be announced in the course.

Courses

Course nr.	**Course name**		
20-00-0004-iv	Functional and Object-oriented Programming Concepts		
Instructor		**Type** Integrated course	**SWS** 8

Module name Algorithms and Data Structures					
Module nr. 20-00-0005	**Credit points** 10 CP	**Workload** 300 h	**Self-study** 180 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Prof. Dr. phil. nat. Marc Fischlin		

1 Teaching content

- data structures: array, list, binary search tree, B-tree, graph representation, hash table, heaps
- algorithms: sorting algorithms, string matching, graph traversal, insertion, search, and deletion for data structures, shortest path search, minimal spanning trees
- asymptotic complexity: run times, Big O notation, complexity classes P and NP, NP completeness
- algorithmic strategies. for example: Divide-and-Conquer, dynamic programming, brute-force, greedy, backtracking, meta heuristics

2 Learning objectives

Upon successful completion of the module students get to know fundamental data structures and algorithms and the complexity classes P, NP, and NPC. They acquire the abilities to apply fundamental principles of algorithmics and to assess and determine asymptotic complexity. Furthermore, they understand major algorithmic strategies and can apply them.

3 Recommended prerequisites for participation

Recommended: Prior attendance of "Functional and Object-Oriented Programming Concepts" or a comparable course.

4 Form of examination

Course related exam:

- [20-00-0005-iv] (Study achievement, Oral/written examination, p/np RS)
- [20-00-0005-iv] (Technical examination, Oral/written examination, Default RS)

See german description.

5 Prerequisite for the award of credit points

Pass exam (100%)

6 Grading

Course related exam:

- [20-00-0005-iv] (Study achievement, Oral/written examination, Weighting: 0 %)
- [20-00-0005-iv] (Technical examination, Oral/written examination, Weighting: 100 %)

7 Usability of the module

B. Sc. Informatik
B.Sc. Wirtschaftsinformatik
JBA Informatik
B.Sc. Informationssystemtechnik
B.Sc. Computational Engineering
Lehramt an Gymnasien - Fach Informatik
Bachelor/Master of Education mit beruflicher Fachrichtung oder Unterrichtsfach Informatik

May be used in other degree programs.

8 Grade bonus compliant to §25 (2)

In dieser Veranstaltung findet eine Anrechnung von vorlesungsbegleitenden Leistungen statt, die lt. 25(2) der 6. Novelle der Allgemeinen Prüfungsbestimmungen der TU Darmstadt und den vom Fachbereich Informatik am 14.07.2022 beschlossenen Anrechnungsregeln zu einer Notenverbesserung um bis zu 1.0 führen kann.

9	**References** Will be appointed in lecture.			
Courses				
	Course nr. 20-00-0005-iv	**Course name** Algorithms and data structures		
	Instructor		**Type** Integrated course	**SWS** 8

Module name Logic Design					
Module nr. 18-sm-1040	**Credit points** 6 CP	**Workload** 180 h	**Self-study** 120 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr. rer. nat. Björn Scheuermann		

1	**Teaching content** Boolean algebra, logic gates, hardware description languages, flipflops, sequential circuits, state-diagrams and -tables, technology mapping, programmable logic circuits
2	**Learning objectives** By this module, Students will be enabled to • rewrite boolean expressions and transform them into circuits of logic gates • analyze and synthesize digital circuits • describe digital circuits in a hardware description language • extract finite state machines from informal descriptions and implement them with synchronous circuits
3	**Recommended prerequisites for participation**
4	**Form of examination** Module exam: • Module exam (Technical examination, Examination, Duration: 90 Min., Default RS)
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module** BSc ETiT, BSc MEC, BSc Wi-ETiT
8	**Grade bonus compliant to §25 (2)**
9	**References** David Harris und Sarah Harris: Digital Design and Computer Architecture

Courses

	Course nr. 18-sm-1040-vl	**Course name** Logic Design		
	Instructor Prof. Dr. rer. nat. Björn Scheuermann		**Type** Lecture	**SWS** 3
	Course nr. 18-sm-1040-ue	**Course name** Logic Design		
	Instructor Prof. Dr. rer. nat. Björn Scheuermann		**Type** Practice	**SWS** 1

Module name Computer Systems I					
Module nr. 18-hb-1020	**Credit points** 6 CP	**Workload** 180 h	**Self-study** 120 h	**Module duration** 1 Term	**Module cycle** Summer term
Language German			**Module owner** Prof. Dr.-Ing. Christian Hochberger		

1	**Teaching content** Types of instruction sets, memory organization and its impact on the runtime, pipelining, instruction level parallelism, superscalar processors, VLIW processors, floating point numbers and operations, memory subsystem, cache types, virtual address spaces, benchmarking and performance prediction, system architecture and bus systems, peripheral devices
2	**Learning objectives** Upon successful completion of the module, students can analyze and evaluate processors, memory systems and bus systems. They can transform structures of high-level programming languages like subroutine calls into sequences of machine instructions. They are able to measure the performance of computers. They know how instructions are executed in modern processors and thus, they can predict the influence of a specific memory hierarchy onto the execution time of a given program. They know how internal and external bus systems work and can define the essential parameters for their dimension and operation.
3	**Recommended prerequisites for participation** Basic knowledge of digital design as it can be obtained by the lecture "Logic Design".
4	**Form of examination** Module exam: • Module exam (Technical examination, Examination, Duration: 90 Min., Default RS)
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module** BSc ETiT, BSc Wi-ETiT
8	**Grade bonus compliant to §25 (2)**
9	**References** • Harris & Harris: Digital Design and Computer Architecture • Hennessy/Patterson: Computer architecture - a quantitative approach

Courses

Course nr. 18-hb-1020-vl	**Course name** Computer Systems I		
Instructor Prof. Dr.-Ing. Christian Hochberger		**Type** Lecture	**SWS** 3

	Course nr. 18-hb-1020-ue	**Course name** Computer Systems I		
	Instructor Prof. Dr.-Ing. Christian Hochberger		**Type** Practice	**SWS** 1

Module name Parallel programming					
Module nr. 20-00-1152	**Credit points** 5 CP	**Workload** 150 h	**Self-study** 105 h	**Module duration** 1 Term	**Module cycle** Every 2. Semester
Language German			**Module owner**		

1	**Teaching content** - foundations of parallel systems - parallel architectures - programming models for parallel computing - parallel algorithms - significant practical programming exercises covering the above topics - if necessary introduction to base programming languages
2	**Learning objectives** After successfully attending this course, students understand the foundations of parallel systems and can apply techniques for their correct as well as efficient programming. They can develop and analyze basic applications using parallel programming techniques on selected platforms.
3	**Recommended prerequisites for participation**
4	**Form of examination** Course related exam: • [20-00-1152-iv] (Study achievement, Special form, Default RS) The form of the examination will be announced at the beginning of the course. One or a combination of a maximum of two of the following forms is possible. Software development (optional: including submission of source code and testata), written exam (duration 60 or 90 or 120 minutes), oral exam (duration 15 or 30 minutes), homework (optional: including testata), colloquium (optional: including presentation), portfolio.
5	**Prerequisite for the award of credit points** Pass Exam (100%).
6	**Grading** Course related exam: • [20-00-1152-iv] (Study achievement, Special form, Weighting: 100 %)
7	**Usability of the module** B.Sc. Computer Science Teacher training at high schools - subject computer science May be used in other degree programs.
8	**Grade bonus compliant to §25 (2)**
9	**References**

Courses

Course nr. 20-00-1152-iv	**Course name** Parallel programming		
Instructor		**Type** Integrated course	**SWS** 3

Module name Operating Systems					
Module nr. 20-00-0903	**Credit points** 5 CP	**Workload** 150 h	**Self-study** 105 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr. phil. nat. Marc Fischlin		

1 Teaching content

- Introduction to Operating Systems (OS) - Role, purpose and design issues
- Processes and Threads - OS structures, process control, abstractions, kernel/user modes and operations, context switching, interrupts
- Inter-Process Communication - Message passing IPC, RPC, layers, interfaces, hierarchies
- Coordination: Deadlocks - Process coordination, critical sections, deadlock characterization, deadlock detection and recovery, deadlock avoidance
- Scheduling/Resource Management - Task ordering, preemptive and non-preemptive scheduling, schedulers and policies, OS implementations
- Concurrency: Races, Mutual Exclusions - Critical sections, races, spin locks, synchronization
- Programming Abstractions: Semaphores - Semaphores, Monitors
- Memory Management - Storage structures, management/replacements approaches, virtual memory, paging, caching, segmentation
- I/O - Device management, drivers, segmentation, interrupt handling, DMA
- File systems - File systems requirements, design and implementation, file structures, directories, naming, partitions, virtual file systems
- Fault Tolerance/Resilience - Fault types, fault handling approaches, reliable message delivery, OS reliability and availability, security issues
- Embedded/RT OS - Memory/disk/performance management, recovery, fault-tolerances, real-time aspects
- Distributed OS - Distributed computation and communication abstractions, synchronization, coordination, consistency
- Virtual Machines - Purpose and types of virtualization, virtual file systems, Hypervisors

2 Learning objectives

Students will gain an overview on fundamental Operating System concepts consequent to their succesful course attendance. Students are able to discuss approaches to different concepts regarding various technical requirements such as fault tolerance, security and performance. Moreover, students acquire techniques for the creation of operating systems.

3 Recommended prerequisites for participation

Recommended:
“Algorithmen und Datenstrukturen”, “Funktionale und objektorientierte Programmierung”, “Rechnerorganisation”

4 Form of examination

Course related exam:

- [20-00-0903-iv] (Technical examination, Oral/written examination, Default RS)

5 Prerequisite for the award of credit points

Pass exam (100%)
Choosing this modul prohibits choosing Modul 20-00-0175 Operating Systems.

6 Grading

Course related exam:

- [20-00-0903-iv] (Technical examination, Oral/written examination, Weighting: 100 %)

7 Usability of the module

	B.Sc. Informatik B.Sc. Informationssystemtechnik May be used in other degree programs.			
8	**Grade bonus compliant to §25 (2)**			
9	**References** - Modern Operating Systems; A. Tanenbaum, Prentice Hall, ISBN 0-13-813459-6 - Operating System Concepts; Silberschatz et al, John Wiley and Sons, ISBN 0-470-23399-3			
Courses				
	Course nr. 20-00-0903-iv	**Course name** Operating Systems		
	Instructor Prof. Dr.-Ing. Andreas Koch		**Type** Integrated course	**SWS** 3

Module name Software Engineering - Introduction					
Module nr. 18-su-1010	**Credit points** 6 CP	**Workload** 180 h	**Self-study** 120 h	**Module duration** 1 Term	**Module cycle** Winter term
Language German			**Module owner** Prof. Dr. rer. nat. Andreas Schürr		

1	**Teaching content** The lecture gives an introduction to the broad discipline of software engineering. All major topics of the field - as entitled e.g. by the IEEE's "Guide to the Software Engineering Body of Knowledge" - get addressed in the indicated depth. Main emphasis is laid upon requirements elicitation techniques (software analysis) and the design of software architectures (software design). Ethical issues are addressed using the "ACM/IEEE-CS Software Engineering Code of Ethics and Professional Practice". UML (2.0) is introduced and used throughout the course as the favored modeling language. This requires the attendees to have a sound knowledge of at least one object-oriented programming language (preferably Java). During the lecture, running examples are utilized to explain and exercise the presented software engineering techniques.
2	**Learning objectives** This lecture aims to introduce basic software engineering techniques - with recourse to a set of best-practice approaches from the engineering of software systems - in a practice-oriented style. After successful completion of the module, students should be able to uncover, collect and document essential requirements with respect to a software system in a systematic manner using a model-based approach. Furthermore, at the end of the course a variety of means to acquiring insight into a software system's design (architecture) should be at the student's disposal.
3	**Recommended prerequisites for participation** sound knowledge of an object-oriented programming language (preferably Java)
4	**Form of examination** Module exam: • Module exam (Technical examination, Examination, Duration: 90 Min., Default RS)
5	**Prerequisite for the award of credit points** Passing the final module examination
6	**Grading** Module exam: • Module exam (Technical examination, Examination, Weighting: 100 %)
7	**Usability of the module** BSc ETiT, BSc iST, BSc Wi-ETiT
8	**Grade bonus compliant to §25 (2)** Grade improvements up to 0.4 per APB 25 (2) due to bonus for regularly submitted homework tasks
9	**References** https://www.es.tu-darmstadt.de/lehre/aktuelle-veranstaltungen/se-i-v and Moodle

Courses

Course nr.	**Course name**		
18-su-1010-vl	Software Engineering - Introduction		
Instructor		**Type**	**SWS**
Prof. Dr. rer. nat. Andreas Schürr		Lecture	3

	Course nr. 18-su-1010-ue	**Course name** Software Engineering - Introduction		
	Instructor M.Sc. Lars Fritsche, Prof. Dr. rer. nat. Andreas Schürr		**Type** Practice	**SWS** 1

2 Studium Generale (usually no FB18 modules)

Please find a detailed module handbook about the Studium Generale online