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

DefaultModule exam:

- DefaultModule exam (Technical examination, Examination, DefaultDuration: 120 Min., Default RS)

5 Prerequisite for the award of credit points

Passing the final module examination

6	**Grading** DefaultModule exam: • DefaultModule 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

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