Valid from 2026.HS

Module description: Signals and Systems 1

Module Code	t.BA.XX.SISY1.06HS
ECTS Credits	4
Language of Instruction/Examination	German
Organizational Unit	ISC Signal & WCOM
Module Coordinator	Marc Kuhn
Legal Framework	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
Module Characteristic	Type 3a 2 lecture lessons per semester week and class + 2 weekly lab lessons per semester and half-class
Module Description	Basics of signals, transforms and linear time invariant systems, in both the time and frequency domains.
Module Content	**Lecture:** • Properties of signals & LTI systems, plus mathematical basics (test signals, complex-exp, convolution) • Display and analysis of periodic signals (Fourier series and spectrum) • Fourier transform and properties • Sampling and reconstruction of signals (sampling theorem, aliasing) • Display of time-discrete signals (DFT, spectrum) • Various representations for LTI systems:Differential equation, frequency response, impulse response, ... • Relationships between the different representations and physical properties of 1st and 2nd order systems (LPF, HPF and BPF) • Simulations and calculations in time (convolution with impulse response) and frequency domain (Bode plots & filtering) **Laboratory:** • Complementing and consolidating the theory • Matching the topics covered in theory: Exercises on PC (using Python) + HW in groups (Common electrical engineering measuring instruments, as e.g. function generator, oscilloscopes, PC audio card ...)
Prerequisite Knowledge	- Complex numbers - Understanding equations with sum signs (+ coding with for-loop)- Plots in logarithmic scale for simple rational functions - Integrals (antiderivative) for: sin, cos, exp, polynomial (ord. 0-3), plus numerical approximation - Integrate with infinity limit, and with variable limits- Ordinary differential equations - Fundamentals of electricity theory and kinetics (for examples)

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Learning Objectives (Competencies)

Students...	Competencies	Taxonomies
Signals:The students are able to characterize and describe signals with properties in the time and frequency domain.	F, M	K3
Systems: Students are able to describe and interpret representations of LTI systems both in time and frequency domains. The students know different representations for 1st and 2nd order systems and are able to code numerical simulations of such systems.	F, M	K2, K3
Transforms: The students know the Complex Fourier series, the Fourier transform and the Discrete Fourier transform. They can code and interpret numerical implementations and/or approximations of these transformations.	M, F	K3

Performance Assessment

End-of-module exam	Assessment	Length (min.)	Weighting	Social Form	Scenario/Format
written exam	Grade	90	70%	acc. to module agreement	

	Assessment	Length (min.)	Weighting	Social Form	Scenario/Format
written exam	Grade	60	20%	acc. to module agreement	
Lab Excercises *The 10 best lab exercices will be graded.*	Grade		10%	acc. to module agreement	

Classroom Attendance Requirement

None

Learning material

- Rennert, I. & Bundschuh, B. (2013). Signale und Systeme. München: Carl Hanser Verlag. ISBN 978-3-446-43327-4.
- Chaparro, L. (2015). Signals and Systems Using MATLAB. 2 Edition. Oxford: Academic Press. ISBN 978-0-12-394812-0.
- Oppenheim, A. & Willsky, A. & Nawab, S. (2014). Signals and Systems. 2 Edition. Pearson Education Limited. ISBN 9781292025902.

Comments

The exam regulation during the "teaching semester" can be varied. But the lecturer has to document and communicate the definitive evaluation form in a module agreement during the first week of the study semester.