

Module: Communications Engineering

Level	Bachelor	Short Name	COM I
Responsible Lecturers	Hellbrück, Horst, Prof. Dr.-Ing.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Elektrotechnik - Kommunikationssysteme, Bachelor		
Compulsory/elective	Compulsory	ECTS Credit Points	5
Semester of Studies	5	Semester Hours per Week	4
Length (semesters)	1	Workload (hours)	150
Frequency	WiSe	Presence Hours	60
Teaching Language	English	Self-Study Hours	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Portfolio Exam	Exam Language	English
Exam Length (minutes)		Exam Grading System	One-third Grades

Learning Outcomes	<p>After completing the course students are able to</p> <ul style="list-style-type: none"> • explain the structure and functions of reference models • describe the characteristics of base band transmission systems as well as systems using digital modulation schemes, • calculate characteristics of transmission lines, e.g. characteristic and input impedance, reflection factor, the influence of the termination on data transmission, • explain the fundamental operation of fibre optics, • draw the output signal of a line encoder following a given encoding algorithm and to assess their characteristic features, • describe the steps from an analog to a digital signal and to determine the values of a sampled signal using a linear or non-linear (PCM, A-law) A/D conversion, • analyze the spectrum of different kinds of modulation (ASK, FSK, PSK, and QAM), • select encoding strategies taking into account the signal-to-noise ratio S/N and the corresponding bit error rate BER, • describe the principles of multiplexing and the different kinds of access methods
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Participation Prerequisites	
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The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	<ul style="list-style-type: none"> ✓ Use of gender-neutral language (THL standard) ✓ Target group specific adjustment of didactic methods ✓ Making subject diversity visible (female researchers, cultures etc.)
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Applicability	
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Remarks	
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Module Course: Communicatione Engineering (Lecture)

(of Module: Communications Engineering)

Course Type	Lecture	Form of Learning	Presence
Mandatory Attendance	no	ECTS Credit Points	3
Participation Limit		Semester Hours per Week	3
Group Size		Workload (hours)	90
Teaching Language	German	Presence Hours	45
Study Achievements ("Studienleistung", SL)		Self-Study Hours	45
SL Length (minutes)		SL Grading System	

The following section is filled only if there is a course-specific exam.

Exam Type		Exam Language	
Exam Length (minutes)		Exam Grading System	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	<p>1. Fundamentals (workload 20h)</p> <ul style="list-style-type: none"> • Reference Models, Functions and Services • Fundamental Terms <p>2. Media (Workload 25h)</p> <ul style="list-style-type: none"> • Wires <ul style="list-style-type: none"> • Shielding, Cancellation, Reflection, Crosstalk Basics • Schematic Representation • Cable Parameters • Wave Propagation • Low Pass characteristic • Reflection and Refraction • Fiber Optics <ul style="list-style-type: none"> • Advantages of Fiber Optics • Main Characteristics of Fiber <p>3. Signals (Workload 25h)</p> <ul style="list-style-type: none"> • Signal Definition and Classes • Representation of Signals • Fourier Analysis and Fourier Integral • Linear Time Invariant Systems (LTI) and Filters • Symbol rate versus Bitrate • Intersymbol Interference (ISI) • Random Signals
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4. Data Transmission (workload 30h)

- Basics of Baseband transmission
- Cables - Copper and Fiber
- Channel Capacity / Nyquist Bandwidth
- Line Coding
- Digital Modulation
- Regeneration
- Example Modem
- Example DSL

5. Information Theory (Workload 10h)

- Stochastic (information) Sources.
- Information and Entropy for stochastic Sources.
- The source coding Theorem.
- Huffmann tree and Huffmann encoding

6. Data Link Layer (workload 50h)

- Framing
- Medium Access
- Error Control
- Flow Control

7. Examples (workload 20h)

- PPP
- Ethernet
- Telecommunication Systems

Literature	Glover, Grant: Digital Communications, Prentice Hall Young: Electronic Communication Techniques, Prentice Hall Tanenbaum: Computer Networks, Prentice-Hall
Remarks	

Module Course: Communications Engineering (Laboratory)

(of Module: Communications Engineering)

Course Type	Practical Training	Form of Learning	Presence
Mandatory Attendance	no	ECTS Credit Points	2
Participation Limit		Semester Hours per Week	1
Group Size	12	Workload (hours)	60
Teaching Language		Presence Hours	15
Study Achievements ("Studienleistung", SL)	Practical Training	Self-Study Hours	45
SL Length (minutes)		SL Grading System	

The following section is filled only if there is a course-specific exam.

Exam Type		Exam Language	
Exam Length (minutes)		Exam Grading System	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	L1: Reflection and Crosstalk L2: Electrical Properties of Copper Cables L3: Signal Analysis L4: Line Coding
Literature	See. Lecture
Remarks	