TECHNISCHE HOCHSCHULE LÜBECK

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 - Energiesysteme und Automation, 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	After completing the course students are able to • 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
Participation Prerequisites	

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

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	

Remarks	

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

1. **Fundamentals (workload 20h)**
   - Reference Models, Functions and Services
   - Fundamental Terms

2. Media (Workload 25h)
   - Wires
     - Shielding, Cancellation, Reflection, Crosstalk Basics
     - Schematic Representation
     - Cable Parameters
     - Wave Propagation
     - Low Pass characteristic
     - Reflection and Refraction
   - Fiber Optics
     - Advantages of Fiber Optics
     - Main Characteristics of Fiber

3. Signals (Workload 25h)
   - 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

	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	