EITM210I Information Theory and Coding

Studiengang	Elektro- und Informationstechnik (Master)
Modulname	EITM210I Information Theory and Coding
Zugeordnete Lehrveranstaltungen	EITM210I Information Theory and Coding
Studiensemester	2nd Semester
Modulverantwortlicher	Prof. Dr. Franz Quint
Dozenten	Prof. Dr. Franz Quint
Sprache	English or German; the course language will be announced at the beginning of the semester
Lehrform, SWS und Gruppengröße	Course, 4h/week
Modus	Mandatory in the study field Information technology, elective in the other study fields of the program
Turnus	Summer semester
Arbeitsaufwand	On-campus program 60 h, self study 90 h
Kreditpunkte	5 CP
Empfohlene Vorkenntnisse	System Theory, Linear Algebra
Voraussetzungen nach Prüfungsordnung	none
Lernziele / Kompetenzen	*Allgemein:* This module provides the information-theoretical foundations of systems for data transmission and storage. The two theorems of Claude Shannon serve as the starting point to a precise mathematical description of information, source and channel coding. *Zusammenhänge / Abgrenzung zu anderen Modulen:* Information theory requires a sound mathematical background. Shannons theorems allow to analyse communication systems from an information-theoretic view point. Thus, this module complements the module Communication Systems of the master's program. The module Information theory however doesn't deal with physical properties of communication channels, but puts emphasis on statistical channel models and uses well-known techniques of digital signal processing, like DFT or Viterbi algorithm on finite fields. *Kenntnisse, Fertigkeiten, Kompetenzen:* Upon successful completion, • the students know the most important source coding procedures • the students know the most widely used channel coding procedures • the students are able to design codes suited for given communication channels • the students are able to implement decoding algorithms • the students are able to analyse communication links from information-theoretical point of view • the students are able to assess the impact of coding on communication links • the students have expanded their mathematical abilities to finite fields
Inhalt	• information, entropy • source coding: arithmetic code and Huffman-code • discrete channel models • channel capacity, Shannon's theorems, Shannon-Hartley-channel-

	capacity • bandwidth efficiency, error probability • Galois-fields and extension fields • design, coding and decoding of Reed-Solomon-codes • design, coding and decoding of BCH-codes • analysis coding and decoding of convolutional codes • code concatenation and interleaving • generalized code concatenation and coded modulation
Studien- und Prüfungsleistungen	Assessment is done by either a written exam (90 minutes) or an oral examination (20 minutes). The form of examination will be announced at the beginning of the semester.
Medienformen	• course manuscript • slides (Powerpoint, PDF) • Matlab simulation programs • excersizes
Literatur	M. Bossert: *Kanalcodierung,* Oldenbourg, München, 2013 B. Friedrichs: Kanalcodierung, Springer, 1996 W. Ryan, S. Lin: *Channel Codes: Classical and modern,* Cambridge University Press, 2009 R. Blahut: *Theory and Practice of Error Control Codes*, Addison Wesley, 1983 S. Lin, D. Costello: *Error Control Coding, Fundamentals and Applications*, Prentice-Hall, 1983 B. Sklar: *Digital Communications, Fundamentals and Applications*, Prentice Hall, 2001