HÖGSKOLAN I GÄVLE

Modulation and Coding 7.5cr

Modulation och kodning 7,5hp

Set by Board of Technology and Built Environment

Version	**Set at**	**Valid from**
	9/26/07	**HT2007**

Level	A1F
Education level	Second cycle
Course identifier	EE443D
Credits	7.5cr
Main field of study	Electronics
Subject group	Electronics
Disciplinary domain	Technology 100.0%

Learning outcomes

The aim of the course is to give knowledge of systems for transmission of electrical signals by dealing with the fundamental theories and applications of digital communication systems from a signal processing point of view.

After finished course the student is expected to:
- Understand and have a good overview over how a digital communication system is working
- Be capable to design and calculate the overall performance of a digital communication system from given fundamental properties and limitations
- Understand and capable to describe the theory behind information transmission of electrical signals
- Adequately describe the different blocks in a digital communication system and understand their contribution to the whole system
- Be capable of implementing digital transmitters and receivers in software
- To some extent be capable of benefiting from scientific reports
- Be capable of finding relevant information on the Internet

Course content

- Introduction to information theory
  Information measures, Channel capacity, and channel models
- Source coding and data compression

Shannon's coding theorem, Huffman coding, predictive coding, and the Lempel-Ziv algorithm
- Representation of band-pass signals and systems
- Linear digital modulation methods
PAM, PSK, QAM, and FSK
- Nonlinear digital modulation methods
Continuous-phase modulation
- Spectrum of modulated signals
- Optimum receivers in AWGN
The Correlation- and matched filter demodulator, optimum detectors, Viterbi algorithm
- Performance calculations
The Q-function, union bound, and decision boundaries
- Channel coding
Block coding and decoding, convolutional coding and decoding
- Performances of forward error correcting coding
- Comparison of different modulation methods
Spectral efficiency, Shannon's limit
- Introduction to spread-spectrum communication
Direct sequence spread-spectrum signals, frequency-hopped s. s. signals, processing gain, and jamming margin
- Aspects as spectrum effiency and energy consumption from a sustainability development point of veiw

Teaching

The education is performed as lectures, exercises, and laboratory work/assignments. The laboratory work/assignments is normally performed in groups of two students. Emphasis is put on the students capability of accomplishing and reporting the work.
The lectures and exercises are not mandatory for the student. However, participation in laboratory work and assignment tasks is mandatory.

Prerequisites

B.Sc. degree in Electronics, Electrical Engineering or equivalent.
Statistical Signal Processing or equivalent.

Examination

Examination is based on:
5 Problem sessions
Laboratory exercise: 156E Digital radio link

Grade

A, B, C, D, E, Fx, F

Other regulations

A written examination is offered at the end of the course.
In addition, approved results from laboratory exercises and assignments are required.

A course certificate is issued if requested by the student, provided that the course is completed and examination results are approved.

Certificate of the course is only awarded after completed and approved course and only upon the student's request.

Sustainable environment

A minor part of the course content deals with sustainable development.

Module

0010	Written examination	5.4cr	Grade: AF
0020	Laboratory excercise	0.6cr	Grade: AF
0030	Assignments	1.5cr	Grade: AF
0040	Written Examination	6.9cr	Grade: TH
0050	Laboratory excercise	0.6cr	Grade: UG