EQ2310 Digital Communications 9.0 credits

Digital kommunikation

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for EQ2310 valid from Spring 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

For single course students: 120 credits and documented proficiency in English B or equivalent

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The student is required to show the following skills to pass the course:

- Identify and describe different techniques in modern digital communications, in particular in source coding, modulation and detection, carrier modulation, and channel coding.
- Carry out, analyze and report simple hardware-based experiments.
- Develop simple software, for example using Matlab, and use this software to simulate and analyze problems within the field, as well as report the development and results.
- Describe and motivate the fact that the implementation and development of modern communication technology requires mathematical modeling and problem solving.
- Apply mathematical modeling to problems in digital communications, and explain how this is used to analyze and synthesize methods and algorithms within the field.
- Formulate a mathematical model which is applicable and relevant in the case of a given problem.
- Use a mathematical model to solve a given engineering problem in the field, and analyze the result and its validity.

To acquire a higher grade, the student is in addition required to show the following skills:

- Identify and describe different techniques in modern digital communications, compare different techniques and judge the applicability of different techniques in different situations.
- Formulate advanced mathematical models which are applicable and relevant in the case of a given problem. When explicit assumptions are missing, the student should be able to judge and compare different possibilities and make own relevant assumptions.
- Use a mathematical model to solve a given demanding engineering problem in the field, and analyze the result and its validity.

Course contents

The course gives a broad introduction to the principles of digital communications. Problem solving based on mathematical modeling is an important part.

Information Theory and Source Coding: Introduction to information theory, entropy, the source coding theorem, quantization, waveform coding (PCM/DPCM/ADPCM, delta-modulation).

Signal Detection: Vector representation of signals, the Gaussian channel (AWGN), optimal receivers, error probability, matched filters, ML and MAP.

Baseband Systems: Signal spectrum. Binary and non-binary modulation. Bit and symbol rate.

Carrier Modulation: ASK, FSK, PSK, QAM. Coherent and non-coherent modulation, CPM, MSK. Symbol and bit-error probabilities. Spectrum and bandwidth.

Channel Coding: Abstract channel models, mutual information, channel capacity, the channel coding theorem. Linear block codes, cyclic codes, convolutional codes. Coding gain, hard and soft decisions. The Viterbi algorithm.

Course literature

Meddelas på kurshemsida i god tid före kursstart. Tidigare år har följande bok använts: "Fundamentals of digital communications," by Upamanyu Madhow, Cambridge University Press, 2008.

Examination

- LAB1 - Laboration, 0.5 credits, grading scale: P, F
- PRO1 - Project Assignment, 1.0 credits, grading scale: P, F
- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Written examination.
Lab exercise.
Project assignment.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.