TSKS02 Telecommunication
Specification of course aims 2018

General

The course syllabus in the study guide (studiehandboken) contains a number of general aims for this course. The teaching activities (lectures, problem solving classes, and course material) are designed to lead towards these aims and the examination evaluates if these have been reached.

This document contains a closer description of the aims listed in the LiU Study info. In particular, it is described how these aims are examined in the course.

The question part of the written exam

The first part of the exam contains a number of sample questions that examines the following three aims.

- **The student should be generally acquainted with classical telecommunication, i.e., be able to briefly describe different telecommunication techniques, and be able to briefly account for some simple channel models.**
  This deals with more or less everything that is treated in the course book, but on a general level. This is not about detail, but about principle descriptions; e.g., being able to describe FM, or to be able to account for things like thermal noise, linear time (in)variant filtering, multipath propagation, fading, and losses.
- **The student should be able to describe problems that arise in telecommunication situations using own words, and be able to describe and, in a relevant way, compare methods to counteract those problems, in deterministic terms.**
  The problems at hand are primarily noise, fading and losses.
- **The student should be able to account for the connection between different concepts in the course in a structured way using adequate terminology.**
  This is about connections between noise and various quality measures, the geometrical interpretation of digital modulation and connections between code parameters and error control properties.

These three aims are evaluated by three questions, which each can give at most five points. At most 15 points are available in this part. One basic requirement for passing the exam is that you have received at least five points from this part.

The problem part of the written exam

The second part of the exam contains a number of sample problems that examines the following three aims.

- **The student should be able to, with some precision, analyze analog modulation methods deterministically in spectral terms.**
  This is about fairly simple calculations on AM, FM and PM.
- **The student should be able to, with some precision, handle sampling and reconstruction of band limited signals deterministically.**
  This is about effects like aliasing and bandlimiting, which both are involved in sampling and subsequent reconstruction. The sampling theorem is important here.
- **The student should be able to, with some precision, compare various standard choices of digital modulation methods and coding methods in terms of error probabilities, minimum distance and related concepts.**
  Those are traditional exam tasks. You should be able to analytically solve given problems from the parts of the course that we treat in tutorials, i.e., the following course parts, and the examination is based on samples from two or three of those parts.

    - *Digital modulation.*
      There can be both binary and non-binary modulation schemes here, only standard choices of schemes. Typically you need to perform error probability calculations, average energy calculations or maximum energy calculations. It is possible that you are asked to compare two modulation schemes in these terms.

    - *Codes for error control.*
      Primarily, we treat linear block codes here, but non-linear codes can also be treated. Those codes are typically fairly small and are analyzed in terms of their parameters, to determine the minimum distance, the weight distribution, the distance distribution, the error correction capability or the error detection capability. Most often, the starting point is a generator matrix or a parity check matrix, and it may happen that a code is created by modifying another code. Some concepts that you should be able to handle here are cyclic codes, product codes, duality, syndrome and decoding.

- *Source coding.*
  You should be able to create a tree code from given source statistics, using the Huffman algorithm. You should be able to analyze tree codes in terms of compression ratios and redundancy. You should be able to use Kraft's inequality to determine if a tree code exists for a given collection of codeword lengths. You should also know and be able to use the concept source extension. Finally, there may be run-length encoding here.

These three aims are evaluated by three problems that need to be solved, where each can give at most five points. At most 15 points are available in this part. One basic requirement for passing the exam is that you have received at least five points from this part.

Laboratory Exercises

There are three computer laboratory exercises in this course, and those are a mandatory part of the examination. The laboratory exercises are done in groups of two students. Normally, you are examined on these laboratory exercises by showing your results to your lab teacher at the end of each lab session. If the scheduled time for a laboratory exercise is not enough for you to finish it and report the results, then you will have to finish the laboratory exercise on your own and hand in a brief written report instead. That should then be done within a week after the scheduled lab session.

The laboratory exercises examine the following learning aims:

- **The student should be able to implement simple telecommunication systems in block form and to empirically evaluate those systems.**
  This is the intention of most of the laboratory exercises. A Lab Memo will be published on this web site later.
- **The student should be able to analyze a given communication channel empirically, and suggest a communication system using that channel that fulfills given demands.**
  This is part of the last laboratory exercise. You will get a partly unknown channel, which you should analyze empirically using tools provided by the teacher. A simple communication system should be constructed that communicates over the given channel.

When you have passed all three laboratory exercises, then the lab part of the examination will be filed in Ladok as LAB1.