

# Telecommunication

Programme course

6 credits

Telekommunikation

TSKS02

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Electrical  
Engineering, Physics and Mathematics

**Date determined**

2017-01-25

## Main field of study

Electrical Engineering

## Course level

First cycle

## Advancement level

G2X

## Course offered for

- Engineering Electronics
- Computer Science, Master's programme

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

From Calculus: Derivatives, integrals and limits.

From Linear algebra: Everything related to linear spaces.

Statistics/probability theory is desirable, but not absolutely necessary.

**Obs!** Students on the national Y, D and Is programs should take TSKS01 Digital Communication instead of this course.

## Intended learning outcomes

After passing the course, 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.
- 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.
- be able to, with some precision, analyze analog modulation methods deterministically in spectral terms.
- be able to, with some precision, handle sampling and reconstruction of band limited signals deterministically.
- 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.
- be able to account for the connection between different concepts in the course in a structured way using adequate terminology.
- be able to implement simple telecommunication systems in block form and to empirically evaluate those systems.
- be able to analyze a given communication channel empirically, and suggest a communication system using that channel that fulfills given demands.

## Course content

- Simple channel models: Cables and radio channels, optical channels. Descriptions of the phenomena thermal noise and fading.
- Analog modulation in deterministic terms: AM, FM, PhM. Spectral properties, demodulation.
- Pulse modulation in deterministic terms: PAM, PWM, PPM, PCM. Sampling, modulation and reconstruction. Aliasing.
- Digital modulation: Common signal constellations, like FSK, PSK, QAM. Error probability expressions.
- Codes for error control: Binary symmetric channels. Binary linear codes, repetition codes, simple parity check codes, Hamming codes, product codes, cyclic codes and CRC codes. Basic parameters like length, dimension, size and minimum distance. Error detection and correction capabilities.
- Source coding: Tree codes, Huffman coding and run-length coding. Entropy, Kraft's inequality.

**Note:** Parts of this course can very well be somewhat simple for students with a thorough electrical engineering background, e.g., students on the programs Y, D and Is. A more reasonable choice in that case is TSKS01 Digital Communication. If that course is combined with TSDT14 Signal Theory, then that allows for more follow-up courses about communication.

## Teaching and working methods

The teaching is given in the form of lectures, problem classes and laborations.  
The course runs over the entire autumn semester.

## Examination

LAB1	Laboratory work	2 credits	U, G
TEN1	Written examination	4 credits	U, 3, 4, 5

The written exam (TEN1) consists of two parts, with minimum requirements in both parts for passing the exam. The first part is a question part, where the course aims

- be generally acquainted with...
- be able to describe...
- be able to account for...

are examined. The second part is a problem part, where the course aims

- be able to, with some precision,...

are examined.

In the laborations (LAB1) the following course aims are examined:

- be able to implement...
- be able to analyze a given...

The written exam can be replaced by oral examination in the event of very few students having signed up for an exam.

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Other information

Supplementary courses: Wireless systems

## Department

Institutionen för systemteknik

## Director of Studies or equivalent

Klas Nordberg

## Examiner

Mikael Olofsson

## Course website and other links

<http://www.commsys.isy.liu.se/en/student/kurser/TSKSo2>

## Education components

Preliminary scheduled hours: 48 h

Recommended self-study hours: 112 h

## Course literature

### Additional literature

#### Books

Mikael Olofsson, *Telecommunication Methods*

Institutionen för systemteknik (ISY), Linköpings universitet. (Course book and problem collection.)

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).