

# Wireless Communications

Programme course

6 credits

Trådlös kommunikation

TSKS13

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Electrical  
Engineering, Physics and Mathematics

**Date determined**

2017-01-25

**Replaced by**

TSKS13

## Main field of study

Electrical Engineering

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Applied Physics and Electrical Engineering, M Sc in Engineering
- Computer Science and Engineering, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Electronics Engineering, Master's programme
- Communication Systems, Master's programme
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering

## Specific information

The course has been withdrawn

## 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

Signal Theory and Digital Communications.

## Intended learning outcomes

The course provides basic knowledge about problems and methods for construction of radio communication systems. The main emphasis is on digital radio systems. In particular it is illustrated how different forms of signal processing are used for the construction of efficient radio communication systems. After completed course the student should be able to

- perform link budget calculations in connection to the design of wireless communication links.
- identify and describe various physical and statistical fading channel models.
- present modulation techniques for wireless communication and their spectral properties as well as evaluate their performance over fading channels.
- give an account for coding techniques which can be used for improvement of the transmission reliability.
- describe and solve problems about direct sequence and frequency hopping band spreading techniques.
- analyse and describe properties for various diversity methods.
- present and use the basic principles for design and analysis of wireless cellular systems
- give an account and solve problems about ARQ and some basic multiple access techniques.

## Course content

Course contents:

Lectures and exercise sessions treat the following areas within radio communications:

- Basics about radio communication systems: utilisation of the frequency spectrum, various radio systems.
- System oriented antenna and wave propagation theory: propagation in free space, in the troposphere, in the ionosphere, basic antenna theory, link budget.
- Probabilistic channel models: fading channels, time and frequency dispersive channels, digital channel models.
- Modulation methods for the radio channel: bit-error-rate analysis in fading channels, spectral properties, spectral efficient modulation, OFDM.
- Diversity methods: principles, weighting, performance.
- Coding for radio channels: methods for burst error correction, coding gain.
- Spread spectrum techniques: frequency hopping, direct sequence systems.
- Wireless packet transmission: ARQ, multiple access techniques - ALOHA and CSMA.
- Wireless cellular systems: basic concepts, frequency reuse capacity calculations.
- Practical examples: GSM, WLAN.

## Teaching and working methods

The course consists of lectures, exercise sessions and a project work. The project is performed in groups of two students. Each group chooses a topic from a list provided by the lecturer. The group work starts with a search for suitable information sources which have to be approved by the lecturer. The work is expected to take approximately 5 weeks and results in a written report. The course is concluded with two lectures where the presence is compulsory on which the groups present their projects. The lectures are given simultaneously with the project work.

## Examination

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

## Grades

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

## Department

Institutionen för systemteknik

## Director of Studies or equivalent

Klas Nordberg

## Examiner

Danyo Danev

## Course website and other links

<http://www.commsys.isy.liu.se/en/student/kurser/TSKS13>

## Education components

Preliminary scheduled hours: 48 h

Recommended self-study hours: 112 h

## Course literature

### Additional literature

#### Books

Lars Ahlin, Ben Slimane, Jens Zander, (2006) *Principles of Wireless Communications*

## 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).