# FIK3624 Wireless Transmission Techniques 9.0 credits

Trådlös transmissionsteknik

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

## Establishment

Course syllabus for FIK3624 valid from Spring 2018

## Grading scale

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## Education cycle

Third cycle

## Specific prerequisites

Open to PhD students admitted to KTH programs.

## Language of instruction

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

## Intended learning outcomes

This PhD course is concerned with different transmission techniques and their performance in different environments.

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Upon completion of the course, the student should be able to:
- Evaluate link performance (bit error rate) in a structured way and evaluate trade-offs.
- Perform system simulations (modulation/demodulation, channel coding/decoding, BER, and channel models).
- Explain and evaluate methods for mitigating wireless channel impairments.
- Describe different types of equalization methods and how they solve the problem of inter-symbol-interference in communication channels.
- Distinguish the difference between forward error control coding and error control coding with feedback, and how they are used in wireless communications of today.
- Demonstrate familiarity with the design and evaluation of modern channel coding methods such as trellis coded modulation, space channel coding.
- Explain the benefits of advanced antenna systems such as MIMO, spacial modulation, and space coding in wireless communication and how can they be used.
- Describe various advanced techniques (CDMA, MUD, OFDM, etc.) and their benefits in communication systems.
- Demonstrate systematic understanding of transmission techniques and their performance.

# Course contents

Overview of different digital modulation methods (PAM, PSK, QAM, FSK, PM).

Performance analysis of different digital modulated signals over wireless communication channels.

Orthogonal Frequency Division Multiplexing (OFDM), principle and applications.

Trellis Coded Modulation (TCM).

Space-time trellis coded modulation and space block coded modulation.

Advanced antenna systems for future wireless communication. MIMO, spacial modulation.

Error control coding with feedback: ARQ and link adaptation in wireless communication.

Spread spectrum transmission and wireless access methods (CDMA, FH, OFDMA).

Interference modeling in wireless communication, joint detection and interference cancellation.

# Disposition

The course is planned to be given every year at the same time as the master course IK2508 (Period 4). The course is a mixture of lectures and exercise sessions. In addition, as compared to the master level course, the students will have to work on research projects (articles) dealing with application and design of transmission techniques.

# Course literature

Principles of Wireless Communications, Lars Ahlin, Jens Zander, and Ben Slimane

Förlag: Studentlitteratur, År: 2006, ISBN: 91-44-03080-0

Selected research papers

# Examination

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.

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

Besides the final exam, the student is required to review a research paper and present results.

# Other requirements for final grade

- Pass the final written exam.
- Approved final report and presentation.

# 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.