EQ2860 Theoretical Foundations of Wireless Communications 7.5 credits

Teoretiska grunder för trådlös 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 EQ2860 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

Knowledge and maturity in the field, corresponding to EQ2310 Digital Communications and EQ2410 Advanced Digital Communications.

Language of instruction

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

Intended learning outcomes

To pass this course the student needs to be able to:

- Identify and describe the fundamental limitations of using the wireless medium for communications, in terms of such objective analytical measures as channel capacity, outage probability, error probability, degrees of freedom, diversity, power efficiency and bandwidth efficiency.
- Identify and describe the different physical phenomena that limit the possible performance of wireless communications.
- Identify and describe modern techniques for high-rate wireless communications, including MIMO transmission, scheduling, multiuser coordination, power allocation, and rate allocation.
- Use and formulate mathematical models for analysis and synthesis of single and multiuser communication links over wireless channels.
- Solve mathematically oriented problems resulting from asking questions about achievable performance and limits of wireless communications.

To qualify for a higher grade a student who has passed the course needs in addition to be able to:

- Utilize such objective analytical measures as channel capacity, outage probability, error probability, degrees of freedom, diversity, power efficiency and bandwidth efficiency, to compare different techniques and scenarios.
- Derive, formulate and use advanced mathematical models for analysis and synthesis of single and multiuser communication links over wireless channels.
- Solve advanced mathematically oriented problems resulting from asking questions about achievable performance and limits of wireless communications.

Course contents

The focus is on the **theoretical foundations of digital communications over wireless channels**, with material building on fundamental principles from information theory, communication theory, detection and estimation, and signal processing. A brief outline of the course contents is as follows.

- Capacity of wireless channels
- Multiuser capacity and opportunistic communication
- MIMO I: spatial multiplexing and channel modeling
- MIMO II: capacity and multiplexing architectures
- MIMO III: diversity-multiplexing tradeoff and universal space-time codes
- MIMO IV: multiuser communication

The three main topics are 1) channel capacity and information theory for wireless communications; 2) multiple-input multiple-output (MIMO) transmission; 3) multi-user scenarios

Course literature

David Tse and Pramod Viswanath “Fundamentals of Wireless Communication”

Examination

- 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

Mandatory homework problems. Written exam.

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.